

Engineering and Structural Adhesives

D.J. Dunn

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*Expert overviews covering the
science and technology of rubber
and plastics*

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Source of original article	→	<i>Item 1</i> Macromolecules 33, No.6, 21st March 2000, p.2171-83	
Title	→	EFFECT OF THERMAL HISTORY ON THE RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC POLYURETHANES Pil Joong Yoon; Chang Dae Han	← Authors and affiliation Akron, University
		The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied with temp. over the entire range of temps. (110-190C) investigated. 57 refs.	← Abstract
Location	→	GOODRICH B.F. USA	← Companies or organisations mentioned
		<i>Accession no.771897</i>	

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Engineering and Structural Adhesives

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1 Introduction

Adhesives are materials designed to hold materials together by surface attraction, often as alternatives to mechanical fastening systems. Adhesives come in several forms - thin liquids, thick pastes, films, powders, pre-applied on tapes, or solids that must be melted. Adhesives can be designed with a wide range of strengths, all the way from weak temporary adhesives for holding papers in place to high strength structural systems that bond cars and aeroplanes. In many industries, adhesives compete with mechanical fastening systems (17) such as nuts and bolts, rivets or welding (40) and soldering.

Engineering and structural adhesives are distinguished from other adhesives by being high strength materials that are designed to support loads, often substantial loads. These adhesives are also often subjected to cycling high and low temperatures and aggressive fluids or the weather. In general they are used for the bonding of rigid structures, although some degree of flexibility or toughness is often desirable in the adhesives to counter the effects of movement, impact or vibration. The most common materials bonded with structural adhesives are metals, glass, ceramics, plastics and composites. Adhesives used for bonding wood in the construction and furniture industry are often structural but wood bonding is usually treated as a subject in its own right and is not covered in this report.

Structural adhesives offer several benefits for the joining of materials:

- They distribute loads across the entire joint area
- They show excellent fatigue properties
- They attenuate mechanical vibrations and sound
- Adhesives often fulfil a dual role of acting as both adhesives and also sealing a joint against ingress of water or other fluids
- Because of their low electrical conductivity, adhesives significantly reduce galvanic corrosion between dissimilar metals
- Joints assembled with adhesives display better cosmetics than joints using welds or fasteners
- Adhesive assembly is often much faster and more cost-effective than mechanical methods

Important properties that must be considered when choosing an adhesive for a structural application include:

- Rate of cure
- Gap filling capability
- Tensile shear strength
- Peel strength
- Impact resistance
- Load bearing capability
- Heat and cold resistance
- Fluid resistance
- Long term durability
- Health and safety issues

2 Types of Structural Adhesives

The number of adhesive technologies for load bearing applications is somewhat limited. Most thermoplastic systems, for example thermoplastic hot melts, are totally excluded because they will creep under load, particularly at elevated temperatures. Crosslinked thermoset adhesives are usually necessary to support loads.

The most important adhesives for engineering applications are:

- Anaerobics
- Epoxies
- Reactive acrylics
- Polyurethanes
- Reactive hot melt polyurethanes
- Special formulations of cyanoacrylates

Several specialised adhesives are available for extreme high temperature service. These include epoxy

phenolic, nitrile phenolic, quinoxaline (301), bismaleimides (137, 215), polyimide (156, 225, 275, 299, 300, 369), and polybenzimidazoles (433). They are used mainly in aerospace applications (354).

2.1 Anaerobic Adhesives

Anaerobic adhesives are one-component liquids that cure rapidly when confined between two surfaces. The adhesives are based mainly on multifunctional methacrylate monomers such as dimethacrylates and trimethacrylates. The term 'anaerobic' was originally used to signify that the adhesives would cure spontaneously when air was excluded and the adhesives are frequently referred to as simply 'anaerobics'. The adhesives are actually free-radical redox systems where a hydroperoxide initiator reacts with transition metals on the substrates, typically iron or copper, to generate free radicals, which then polymerise the monomers. However, as with most free radical systems, atmospheric oxygen is a strong retarder and thus the systems polymerise rapidly in an assembled joint, but will not cure if placed on a surface in the atmosphere.

Anaerobics typically comprise:

- Monomers
- Initiators
- Accelerators
- Plasticisers
- Stabilisers
- Thickeners
- Fillers
- Other additives

Although the range of useable additives is quite large, all additives have to be chosen and tested carefully. Anaerobics can be destabilised by certain types of impurities, for example traces of transition metals such as iron or copper, peroxides and amines.

Their one-component nature and ability to cure at room temperature are huge benefits to any user and these are the unique features that distinguish them from all other high performance adhesives, with the exception of cyanoacrylates. They are available in a wide range

of viscosities from thin liquids to almost solid gels. The use of multifunctional monomers in anaerobics leads to a highly crosslinked thermoset polymer that is heat resistant and has excellent oil and solvent resistance.

Anaerobics cure very quickly on clean iron, steel or brass surfaces where transition metal ions catalyse the initiation of polymerisation. However, they cure more slowly on plated surfaces, on oily surfaces or in the presence of certain rust-inhibiting chemicals, such as chromates. For very inactive surfaces or for fixturing on plastics, surface primer solutions are used (usually amines or copper salts).

The fact that the polymerisation of anaerobics is initiated from the surface of the substrates being bonded gives them a deficiency in common with cyanoacrylates, *viz.* a very limited capability to fill large gaps. Primers have to be used to improve this situation, thus negating the one-component benefit of the adhesives.

In common with many organic liquids, the liquid anaerobics can embrittle and stress-crack some plastics and testing needs to be done before using them on plastics in general. Speeding up the curing with primers will often eliminate this problem.

Toughening of anaerobics by using urethane methacrylate monomers or by incorporating rubbers has been moderately successful, to create (expensive) structural adhesives. However, in contrast to other tough adhesives like reactive acrylics and polyurethanes, they remain relatively brittle materials.

The best known application of anaerobics is to replace lock washers in threaded fastener assemblies (e.g., nuts and bolts), where they fulfil the dual function of locking and sealing the assembly. Frequently referred to as liquid lock washers, anaerobics adhere strongly to the metal surfaces and prevent loosening from vibration (438). They also completely fill the void space in a threaded assembly and protect it against corrosion. This is still the most distinctive application for anaerobics because they do not merely act as a liquid alternative to lock washers but truly augment the assembly, particularly in situations under vibration, such as in vehicle applications. To remain effective, assembled fasteners must maintain tension and the adhesion provided by an anaerobic adhesive increases the forces required to loosen the assembly. Furthermore, even if an assembly should loosen, the fastener will not disassemble completely (such as a screw falling out or a

nut coming off) because the cured anaerobic completely fills the void spaces between threads - thus preventing catastrophic failures.

Threadlockers can be formulated to have very low strengths, such as for small adjustment screws, medium strengths for assemblies requiring disassembly, or high strength for permanent assemblies.

In addition to liquid anaerobics, threadlockers are supplied in a solid form that can be pre-applied to a fastener. In these systems, the anaerobic adhesives or a catalyst are microencapsulated in a thin shell. This pre-applied system remains stable until a nut is applied to the fastener when the shearing action of engagement breaks the microcapsules and the adhesive cures, locking the fastener.

Structural anaerobic adhesives are also used for face-to-face bonding and for the bonding of slip fitted cylindrical parts (often called 'retaining' compounds).

2.2 Epoxy Adhesives

Epoxyes have historically been the major adhesive family used for structural bonding of metals and composites in the aerospace, industrial and automotive industries. They are characterised by curing to hard infusible resins that bond to a wide range of metals and have excellent heat and environmental resistance. Epoxyes have been used since the 1940s and have an excellent track record of successful structural bonding. Both two-component and heat cured one-component versions are available and literally thousands of formulations have been developed over the years for specific applications.

A typical two-component epoxy adhesive comprises:

- Epoxy resin
- Hardener

- Fillers
- Plasticisers
- Accelerators
- Reactive diluent
- Toughening agents

The epoxy resin and hardener are kept separated in the two components of the adhesive but the other components can be formulated into either portion to adjust the viscosity and help in adjusting the mix ratio of the two components.

The most commonly used epoxyes in adhesives are based on the diglycidyl ether of bisphenol-A (DGEBA) (**Figure 1**).

There are several different types of hardeners used in the curing:

- Aliphatic amines
- Amidoamines
- Aromatic amines
- Cycloaliphatic amines
- Imidazoles
- Polyamides
- Anhydrides
- Polysulfides
- Dicyandiamide (DiCy)
- Boron trifluoride adducts

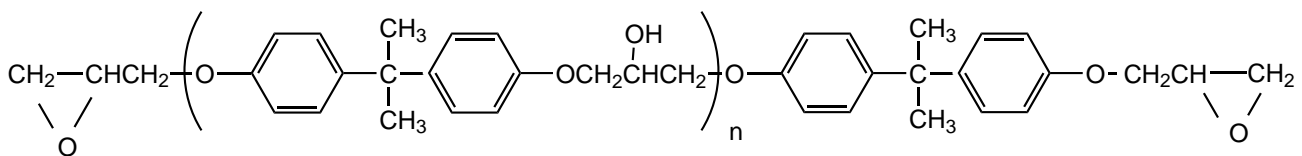


Figure 1

DGEBA structure

The cure kinetics and the glass transition temperature (T_g) of the cured resin are dependent on the molecular structure of the hardener. Recently, ferrocenium salts have been shown to generate Lewis acids on UV irradiation and to cure epoxies efficiently after subsequent heating (128). New low-odour polymercaptopan hardeners have been introduced (134).

In all cases precise measuring of resin and hardener is essential to enable the condensation reactions to go to completion - this is one of the negative aspects of epoxy adhesives. Many application systems are now available that allow pre-measured amounts of resin and hardener to be dispensed and mixed.

The versatility of epoxy resin systems arises from the large number of combinations of epoxy resins and hardeners, each of which gives a different cure profile and results in a different molecular structure in the resulting polymer. Compared to some other adhesive systems, such as cyanoacrylates or anaerobics, epoxies are not very sensitive to impurities. This gives tremendous scope for modification of their properties by additives, modifiers, fillers, rubber tougheners, plasticisers and other polymers to customise the adhesives for specific applications.

Epoxies are quite versatile, high strength adhesives with excellent performance on metals, ceramics and glass. They will fill very large gaps, which is a major advantage over alternative systems like reactive acrylics and cyanoacrylates and have excellent thermal and fluid resistant properties. Recent developments include the preparation of liquid crystal resins based on methacrylated epoxies (79, 81). These resins have been shown to have very high adhesive strengths.

Disadvantages of epoxies include their two-component (or heat cure) form, reduced performance on oily surfaces, their inherent lack of toughness and limited performance on plastics, where reactive acrylics, cyanoacrylates and polyurethanes are usually superior. Also, because the base resins are relatively high molecular weight species, it is not possible to formulate very low viscosity adhesives, unless reactive diluents are added, with a corresponding drop in performance.

One of the traditional weaknesses of epoxies, namely, their brittleness, has been the focus of research attention for the last 20 years or so and significant breakthroughs have been made to produce tougher epoxies by the incorporation of rubbers such as carboxy terminated butadiene-acrylonitrile (CTBN) (127), polysulfides and urethanes (323). Work on the bonding of oily steel and

aluminium has shown that strengths can be improved by incorporating hydroxy-functional polyester oligomers in the adhesives (353) and that absorption of oil or dry film lubricants by adhesives can be greatly accelerated by the application of heat during curing (87, 314, 357). The necessity for long cycle times for the heat curing of epoxies has been mitigated in many automotive and industrial applications, firstly by using current paint bake ovens in the automotive industry to cure the adhesives and secondly by using technologies like induction heating where parts can often be fixtured in seconds and cured in minutes rather than hours (260).

2.3 Reactive Acrylic Adhesives

Reactive acrylics are two-component 100% reactive systems, based on methacrylate and acrylate monomers that are toughened with dissolved rubbers and are cured either by using a surface primer, or by mixing two components together (13). Reactive acrylic adhesives are based on acrylic and methacrylic monomers, and polymerise free-radically similar to catalysed anaerobic adhesives. However, very significant differences exist. Whereas the monomers in anaerobics are predominantly difunctional or trifunctional in order to achieve highly crosslinked thermoset systems, reactive acrylics are based mainly on monofunctional monomers, e.g., methyl methacrylate or cyclohexyl methacrylate.

Reactive acrylics are differentiated from other two-component adhesive systems like epoxies or urethanes by the fact that the cure is catalytic, relatively insensitive to the amount of catalyst used and does not depend on mixing precise stoichiometric amounts of adhesive and catalyst.

These adhesives have proved to be extremely useful in demanding plastic and metal bonding applications where fixture times of a few minutes and strong, impact resistant bonds are required. Applications include fibreglass and sheet steel bonding, magnets, loudspeakers, sporting goods, miscellaneous metal and plastics assembly, particularly when fast curing with no surface preparation is desired. Reactive acrylics have been very successful in applications such as bonding automotive bumpers (370) and assembling boats (89, 117, 120, 123, 124, 150, 175, 187).

Acrylic adhesives do have the inconvenience of being two-part systems and many have unpleasant odours and are flammable (although low odour versions are available (212)). Other limitations of these adhesives

include high temperature resistance only to about 120 °C and limited resistance to very aggressive solvents.

Reactive acrylics can be formulated as one-component systems by adding photoinitiators and then curing by exposure to UV radiation. Adhesive systems which use UV or visible light to begin the curing are intrinsically very attractive systems to the manufacturing engineer, allowing assembly of components and then ‘curing on command’ by exposing to the UV irradiation.

2.4 Polyurethane Adhesives

Polyurethane adhesives are tough adhesives based on the formation of a polyurethane by reacting a polyol with an isocyanate. The isocyanate group reacts with the hydroxyl groups of a polyol to form the repeating urethane linkage (**Figure 2**).

Crosslinking of polyurethanes is necessary to create structural adhesives that will not creep under load. Crosslinkable urethane systems can be formed in one of two ways - either by using an excess of isocyanate in the reactions where the excess isocyanate can react with urethane groups in the polymer to form allophanate crosslinks, or by using multifunctional polyols or isocyanates (138).

Polyurethane engineering adhesives can be formulated as one- or two-component systems that cure to very tough flexible adhesives. One-component systems are cured using heat or atmospheric moisture (or can be misted with sprayed water), whereas two-component systems must be mixed thoroughly before use.

Two-component systems are the most common type used in structural adhesives. These adhesives consist of two relatively low molecular weight components: the polyol and isocyanate. The components are mixed together to cure to the polyurethane. These types of adhesives are much faster curing than one-component systems.

Polyurethane adhesives are inherently quite flexible without added tougheners. Even the crosslinked polymers behave somewhat like thermoplastic elastomers with two-distinct phases - the hard phase contributed by the isocyanate and the soft phase from the polyol.

Polyurethanes do not have the extreme high performance of highly crosslinked epoxies or anaerobics or the instant curing of the cyanoacrylates, but they are extremely versatile systems that can be formulated from hard to very flexible systems to form tough bonds with high peel strength. In many large area bonding situations they compete with reactive acrylics.

The largest single application for polyurethane adhesives is the structural bonding and sealing of automotive windshields and they have also proven to be very effective in large area panel bonding of metals and composites (226, 227, 262, 344, 379).

2.5 Reactive Hot Melt Polyurethanes (RHMUs)

RHMUs are a relatively new technology, and are single-component adhesives that are applied molten like conventional hot melt adhesives, with virtually instant fixturing, and then cure by reaction with atmospheric moisture to give a crosslinked adhesive. RHMUs are polyurethanes based on the end capping of high molecular weight polyester or polyether polyols with isocyanates. After preparation the polymers must be stored and packaged under dry conditions.

The adhesives are applied in molten form and then a moisture-induced crosslinking reaction takes place that can take up to 72 hours for completion, depending on atmospheric humidity and temperature. New technology to improve the rate of strength build up of these adhesives has been reported (171).

RHMUs are very versatile adhesives whose major limitation is the expensive equipment required for storage

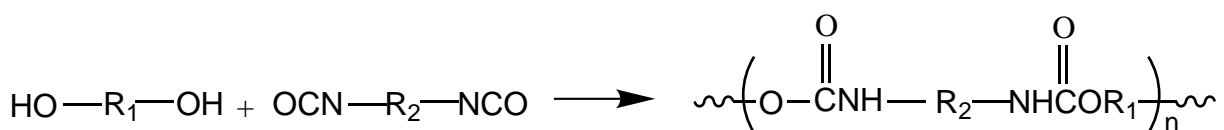
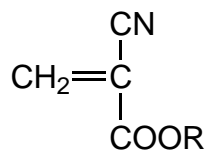


Figure 2
Urethane structure

and application. Major structural applications for RHMUs include the assembly of large panels for recreational and commercial vehicles (45), the bonding of steel panels with an expanded polystyrene core for the production of insulated garage doors and the lamination of PVC sections for window construction (91).

2.6 Cyanoacrylate Adhesives

Cyanoacrylates are the so-called one-component instant adhesives, and are based on a special type of acrylic monomer that is an ester of 2-cyanoacrylic acid:



2-cyanoacrylate

where R = an alkyl group, e.g., methyl, ethyl, butyl, octyl, allyl, ethoxyethyl

The electron withdrawing (electrophilic) cyano group makes these monomers very susceptible to polymerisation by nucleophilic species, i.e., they polymerise anionically. Even very weak nucleophiles

such as the hydroxyl ions from atmospheric moisture on surfaces are sufficient to polymerise the monomers in seconds, when they are confined between two surfaces. Cyanoacrylates bond a wide range of materials including metals (173), plastics and composites.

Cyanoacrylates traditionally were not considered as structural adhesives because of their thermoplastic nature, brittleness and limited thermal resistance. However, most of these weaknesses of cyanoacrylates have been eliminated in recent years by toughening with certain elastomers, and these adhesives can certainly be considered as true (though expensive) structural adhesives.

Table 1 compares the properties of the different types of structural adhesives.

3 Applications for Adhesives

Structural adhesives are used in a wide range of industries, most frequently to bond metals, plastics, composites and to some extent, glass and ceramics.

Table 2 shows the most important application market segments for structural adhesives with appropriate references.

Table 1 Comparison of adhesives

	Anaerobics	Epoxies	Reactive acrylics	Polyurethanes	Cyanoacrylates	RHMU
Relative rate of cure	Medium	Slow	Fast	Slow	Very fast	Fast fixture – slow cure
Gap filling	0.5 mm	No limit	1 mm	No limit	0.5 mm	3-5 mm
Tensile shear strength	21-28 MPa	21-35 MPa	21-28 MPa	10-14 MPa	14-21 MPa	7-14 MPa
Peel strength	Very low	Low	High	Very high	Low	High
Impact resistance	Very low	Low	High	High	Low	High
High temp. resistance	200 °C	200 °C	150 °C	180 °C	100 °C	150 °C
Fluid resistance	Excellent	Excellent	Good	Fair	Fair	Fair
Cost	High	Low	Medium	Medium	Very high	High

Table 2 Applications for adhesives	
Market segment	References
Automotive assembly and repair	109, 110, 157, 171, 187, 200, 202, 207, 264, 313
Marine	76, 325
Aerospace	159, 289, 383
Railway	93, 177, 203
Threaded fasteners	66, 304, 438
Sandwich panels	80
General industrial assembly	179, 211
Appliances	66
Electrical	105
Sports equipment	199, 201

4 Advances in Adhesives

4.1 Bonding of Metals

Although new materials like plastics and composites have replaced metals in many industrial and household products, metals will continue to be used where their unique combination of properties such as high strength and high temperature resistance are coupled with low cost.

Adhesive bonding is usually not the only possible joining method for metals available to the design engineer. **Table 3** shows the strengths and weaknesses of adhesive bonding of metals compared to other methods.

Other technologies and combinations of technologies that can be used are:

- Mechanical clinching - this is a form of mechanical fastening which involves the joining of two sheets of metal by deep drawing the sheets into a cup shape using punch and die tooling.
- Clinch bonding - This technique combines mechanical clinching and adhesive bonding.
- Weld bonding - This is a process that combines adhesive bonding with resistance spot welding and is carried out by either spot welding through an

uncured adhesive joint or by flowing adhesive into a spot welded joint (284, 348).

- Rivet bonding - the combination of a small number of rivets and a structural adhesive can usually give a much stronger assembly than a large number of rivets used alone (99). This process has been widely used in the assembly of school buses for many years (48).

These combination techniques ensure high fatigue strength of the structures and are extremely economical, because they do not require any fixturing during the curing of the adhesive.

Epoxy adhesives have traditionally been the most commonly used adhesives for metals in industrial and aerospace applications. Reactive acrylics have been shown to be very effective in bonding unprepared surfaces such as those contaminated with drawing or cutting oils. Researchers at Henkel-Loctite have recently shown that by adding activators to common cutting oils, reactive acrylics can be cured by metal surfaces fabricated with these lubricants (a.1). Cyanoacrylate adhesives are very effective in the rapid assembly of small metal components. However, cyanoacrylates traditionally have poor impact strength and low adhesive peel strengths. A major breakthrough was the discovery that certain compatible rubbers, e.g., ethylene-acrylic rubbers could give adhesives with high impact strength (a.2). It was also unexpectedly found that these compositions had excellent hot strength, i.e., resistance to thermal degradation of strength properties, and also, elimination of post-cure embrittlement or loss of toughness properties which occurs with cyanoacrylate adhesive bonds upon exposure to heat and then cooling to room temperature. These rubber-toughened cyanoacrylates are true one-component structural adhesives, although somewhat slower curing than regular cyanoacrylate adhesives.

In addition to the joining of iron and steel, technologies for the joining of other metals are being researched in order to produce assemblies of exceptional strength and durability under high stress situations and in hostile environments. One driving force for using alternative metals is the tremendous weight savings that can be achieved through the use of so-called 'light metals' such as aluminium and magnesium. This is of particular interest to the automotive industry where weight savings can be translated into considerable gains in both fuel economy and performance (330).

Aluminium is 60% lighter than steel and has a very good strength to weight ratio. The metal has excellent

Table 3 Comparison of assembly methods for metals

	Adhesive bonding	Mechanical fastening	Soldering/ brazing	Arc welding	Spot welding	Riveting
Joint stresses	Uniform distribution	Point of high stress at fasteners	Fairly uniform distribution	Fairly uniform distribution	Local stress points in structure	Local stress points in structure
Fatigue resistance	Excellent	Need to prevent vibration loosening	Good	Special methods often necessary to enhance resistance	Often poor	Good
Use for dissimilar metals?	Excellent for most combinations	Usually good – some problems with soft metals	Some capability	Limited capability	Limited capability	Excellent
Joint preparation	Cleaning and pretreatment often necessary	Hole drilling or tapping required	Pre-fluxing necessary	Little or none required	Little or none required	Holes when non-piercing rivets used
Temperature resistance	Limited	Very high	Limited by softening point of metals used	Very high	Very high	Very high
Joint appearance	Invisible bond lines	Surface discontinuities often show	Usually acceptable	Usually acceptable	Surface discontinuities often show	Surface discontinuities often show
Production speeds	Slow to fast depending on adhesive type	Slow to medium	Can be very fast	Can be very fast	Can be very fast	Can be very fast
Material costs	Low	High	Medium	Low	Low	High
Operating costs	Low	Medium	Medium	High	Medium	Medium
Capital costs	Low	Low	Low	High	High	Low

corrosion resistance and is used widely in industrial, construction and consumer goods. Aluminium has a lower torsional and beam stiffness than steel, but structural adhesives can reinforce it to meet or exceed the steel properties (362).

Non-ferrous metals like aluminium, magnesium and titanium have been bonded using high performance epoxies and nitrile-phenolics in the construction of aircraft, often in combination with other fastening methods such as rivets. Lengthy and expensive pretreatment and curing processes have been designed to ensure absolute reliability in bonded joints, both in terms of structural strength and resistance to corrosion. Although this experience gives confidence to the non-aerospace design engineer, most of the assembly processes used in aerospace are totally incompatible with the rapid production line assembly operations practiced by industrial and automotive manufacturers. Hence there has been considerable research into finding better and more economical methods of preparing and bonding metals, particularly for automotive applications (47).

4.1.1 Bonding of Aluminium

Alcoa researchers (a.3) compared different methods of joining aluminium to determine its suitability for automobile body construction. Because the automobile body is designed for stiffness, most structural parts sustain relatively light loads. However, certain points in the structure such as attachment points for suspension components and engine mounts are very highly loaded. In these cases, fatigue is a major consideration. Fatigue and static strength testing of joints with various aluminium alloys show that adhesive bonding, rivets, rivet-bonding and weld bonding all outperform spot welds and have greater performance than that required for the application. In crush-test specimens, adhesive bonding alone gave some indication of failure due to peel forces. Warren (a.4) at Alcan described the assembly of aluminium automobile panels using weld bonding with a rubber-toughened epoxy adhesive.

In work sponsored by the aluminium industry and by Audi and BMW, Lachman (329) compared the bonding of steel and aluminium alloys using three epoxy adhesives. Steel was used in a bare state and also zinc coated. Bonds were tested immediately after curing and after several months weathering. It was concluded that with both metals, adhesive bonding gives much better fatigue life than spot welding. All weathered specimens show some reduction in fatigue life, although corrosion

is the dominating degradation mechanism in the steel specimens and diffusion of moisture to the adhesive-metal surface in the case of the aluminium alloys.

Authors from 3M (a.5) described the testing of two speciality epoxy adhesives for aluminium, designed for hem flange bonding and panel bonding respectively. These adhesives show outstanding sustained load durability in cyclic corrosion tests even when stressed to 40% of their initial shear strengths.

Ford Research Laboratories (a.6) have evaluated the fatigue behaviour of aluminium alloy joints and showed the enormous benefit of using an epoxy adhesive in combination with spot welding or mechanical clinching. Weld bonding improves fatigue strength by approximately 400% over spot welding and clinch bonding, and by approximately 325% over clinching alone. The authors attribute the improvements to the increase in overall bond area when adhesives are used, the stiffness provided to the joint area by the adhesive and to the fatigue resistance of the adhesive itself.

Work in the UK (418) described the attachment of stiffeners to steel and aluminium alloy plates using epoxy and reactive acrylic adhesives. The results of fatigue testing suggested significant improvement over welded specimens. A significant finding was that the high modulus epoxy adhesive failed by cracking in the adhesive layer, whereas the lower modulus tough acrylic adhesive showed no cracking and final failure was always in the metal plates.

As part of a US Army sponsored program, Martin Marietta Laboratories (436) conducted mathematical joint analysis and tested prototypes of tubular aluminium alloy joints bonded with a toughened adhesive. It was found that the tubes fail by tubular buckling at loads considerably lower than the expected limit load of the bonded joint.

4.1.2 Bonding of Dissimilar Metals and Metals to Other Substrates

Japanese researchers (437) described a stress analysis of butt joints of steel to aluminium where joints were assembled with epoxy adhesives and were subjected to cleavage loads. They found that the normal and shear stresses are maximised at the edge of the interface on the load application side between the adherands and the adhesive bond. However, both stresses are greater at the edge of the interface between the higher modulus adherand (steel) and the bond.

Ikegami and co-workers (394) studied the connecting of two shafts using a bonded cylindrical coupling instead of flanges. The shafts were steel and the couplings either aluminium alloy or brass. On bonding with an epoxy adhesive, good correlation was found between calculated joint strengths and initial failure load of the joint.

Aluminium bicycle frames are being successfully bonded with epoxy adhesives (358, a.7) to replace traditional brazing methods. A process developed by the Raleigh Cycle Company and Permabond International utilised a Permabond ESP epoxy adhesive to bond aluminium alloy frame tubes to steel lugs and stays. After heat curing these frames withstood a minimum 55 MPa tensile strength test. Usually the metal tube collapsed before the bond broke.

New epoxy hardeners based on chelated chromium complexes have been shown to give higher modulus adhesives and higher adhesive strengths than conventional amine hardeners when tested on aluminium to steel joints (126). The effect of the plating of steel with different alloys has been investigated with regard to adhesive bonding (309).

H. Flegel of Daimler-Chrysler has described the use of structural adhesives in autobody construction and concluded that modern lightweight design, safety, and modular concepts can no longer do without adhesively bonded joints and the strength they provide in a crash scenario (a.8). With reference to the Mercedes S Class coupe, he describes that it is a multimaterial design using steel in areas such as roof pillars, longitudinal members and cross members that are subjected to high loads during a crash; aluminium for the manufacture of large-area parts such as the hood, roof, tailboard and rear fender; magnesium for the interiors of the doors and plastic for attachments such as the trunk lid, bumper and front fender. The body-in-white is adhesively bonded and reinforced using self-piercing rivets. The combined joining method considerably increases the energy absorption capacity and hence the crash resistance, in contrast to spot welded joints. In addition, the structural rigidity of the body can be increased, depending on the vehicle design, by about 15 to 30% compared with welded components. Some 90 metres of adhesively bonded joints are used in this vehicle.

Recent studies on the bonding of steel to concrete (82, 83), and to wood (100) have been reported.

4.2 Bonding of Plastics and Composites

4.2.1 General Plastic and Composite Bonding

There has been a tremendous increase in recent years in the use of plastics and composites to replace metals in component design. Since plastics do not always lend themselves to traditional methods of fastening, there have been increasing demands for adhesive bonding of these materials. The mass production of cars with aluminium and plastics replacing steel in body structures is still some years away for both cost and performance reasons, but many components such as doors, fenders, hoods and trunk lids are now manufactured out of materials like thermoset polyurethane, unsaturated polyester sheet moulding compounds (SMC) and aluminium. Mechanical fastening and heat curing cannot be used with these systems and adhesive bonding with materials such as two-component epoxies and polyurethanes is employed.

Three types of plastics based materials can be categorised for bonding:

- Thermoplastics - e.g., polystyrene or polyethylene
- Thermosets - e.g., phenolics or epoxies
- Composites - plastics reinforced with a mineral or metallic filler (161, 188). Composites can be thermoplastics or thermosets

From the adhesives technologist's point of view, plastics are somewhat of an anomaly: on the one hand bonded joints can be made where the plastic fails before the adhesive; on the other hand certain plastics are very difficult to bond. Although plastics often present difficulties in adhesive bonding (**Table 4**), all can be

Table 4 Problems in bonding plastics
• Inherent flexibility of plastics – induces peel and cleavage stresses in bonds
• High thermal expansion coefficients compared to metals
• Stress cracking from liquids
• Presence of mould release agents
• Low polarity surfaces

joined successfully with the correct choice of adhesive, joint design and surface preparation (251).

Structural adhesives for plastics are typically epoxies, cyanoacrylates, polyurethanes or reactive acrylics.

The major factor that has limited the penetration of epoxies into plastics bonding applications has been their brittleness. Rubber toughened systems have improved this problem to a certain extent and some successful applications have been reported in bonding thermoset plastics (144, 148) and in repairing fibreglass panels (263). Epoxies are also the most widely used systems for repairing graphite-reinforced epoxy composites in the aircraft industry (292, 321).

Two-component polyurethanes are extremely versatile in plastics bonding and are used widely for polyester SMC bonding where their good adhesion and high flexibility are key properties. Limitations include the moisture-sensitivity of the isocyanates leading to foam formation, the need for primers for some surfaces, and some health and safety concerns regarding the toxicity and irritancy of isocyanates (102).

Cyanoacrylates are probably the most versatile adhesives for plastics with excellent adhesion to most plastics. Limitations include gap filling only to 0.5 mm, temperature resistance to about 100 °C and poor impact resistance.

Reactive acrylics have excellent plastics bonding abilities due in part to their solvency for many plastics. However this can cause stress cracking in some cases. The major limitation of this class of adhesive is limited gap filling to about 1 mm. Two-part mixable versions of these adhesives have greater gap filling ability, leading to even greater capabilities for structural bonding and repair of plastics and composites (188). Recently, versions of these adhesives have been prepared with very long and controllable open times, which allows the assembly of very large components such as composite bridges, windmill blades and transportation vehicles (19). Photoinitiated acrylics are also available and can be cured in 1-30 seconds using UV or visible light. These have been used successfully on transparent substrates like PVC and polycarbonate.

4.2.2 Bonding of Specific Plastics

Thermoset polyesters are glass fibre reinforced unsaturated polyesters and are often referred to as SMC

or 'fibre reinforced plastics' (FRP) or simply 'fibreglass'.

Urethane adhesives are the clear market leader in this area, particularly in the automotive industry where their resilience and resistance to peel, fatigue and impact have made them the first choice for large area panel bonding (316), although primers are sometimes needed. Toughened epoxies are used where more load-bearing capability is needed (53) such as for the assembly of composite self-supporting walls (74). Reactive acrylics have also been shown to be very versatile adhesives for these materials (213), particularly in boat building applications. They can be used without primers and have an excellent combination of rapid curing, resilience and load bearing properties. Cyanoacrylates perform well in small gap situations where 'instant' cure is the dominant requirement.

Thermoplastic polyesters include unfilled or reinforced grades of polycarbonates, polyethylene terephthalate, polybutylene terephthalate and blends and copolymers of these plastics. Cyanoacrylates and urethanes bond well to these materials. UV-cured acrylics are suitable for transparent plastics like polycarbonate.

Styrenic thermoplastics include polystyrene itself, acrylonitrile-butadiene-styrene copolymers (ABS) and plastic blends such as polyphenylene oxide/styrene. Most adhesives can be used to produce strong bonds with these plastics, but primers and solvents should be tested carefully for solvent attack or cracking.

Polyvinyl chloride (PVC), often referred to as simply 'vinyl' comes in rigid and flexible forms. The latter, which is heavily plasticised, can often cause bonding problems because of the plasticiser exuding into the bond line. Cyanoacrylates and reactive acrylics are usually suitable for both rigid and flexible versions but testing is essential.

Acrylic plastics such as polymethylmethacrylate (PMMA) are sometimes solvent welded. Acrylics, urethanes and cyanoacrylates are good adhesives but stress cracking can occur with highly stressed parts.

Acetals, often used for their lubricating properties and chemical inertness, can be quite difficult to bond. Abrasion or chemical surface treatment increases the strengths. New surface primers allow very good bonding with cyanoacrylates.

Polyamides (nylons) can be bonded well with cyanoacrylates, epoxies and acrylics. Careful durability

testing of joints is recommended because of the tendency of the plastic to absorb atmospheric moisture.

4.2.2 Bonding of Non-Polar Plastics

When attempts are made to bond non-polar plastics such as polyethylene, polypropylene, fluoroplastics and thermoplastic polyolefins (TPOs), very weak assemblies are usually obtained with tensile shear strengths of less than 0.7 MPa and which readily fail under slight impact or exposure to moisture (62).

There are several methods that have been used to improve the bonding.

4.2.2.1 Flame Treatment

Flame treatment is widely used to prepare polyolefin surfaces for adhesive bonding, particularly in labelling operations. This method is purported to burn off contaminants and weak boundary layers and also produces surface oxidation. Although flame treatment can be readily automated on a container labelling line it is very impractical for most product assembly operations.

4.2.2.2 Chemical Surface Treatment

The chemical modification of low energy polymer surfaces is carried out typically by treatment with metallic sodium complex dispersions (for fluoroplastics), chromic acid etching, bleach/detergents, potassium iodate/sulfuric acid and other mixtures.

Dutch authors (434) have shown that pretreatment with oxidising acids can increase the adhesive strengths of polyethylene bonded with epoxy adhesives by as much as 600%. Surface analysis of treated specimens indicated the generation of functional oxygen-containing groups, i.e., hydroxyl, carbonyl, and carboxyl. Similar work using chromosulfuric acid and chromyl chloride was reported by Czech researchers (349).

Treatment of polytetrafluoroethylene (PTFE) with sodium complexes also gave strong evidence of surface oxidation and results in up to 10-fold increases in bond strength with epoxy adhesives (363).

Although bond strengths can be improved significantly by these chemical methods, they are time consuming, expensive and inconvenient in high volume production

situations. There is also the problem of disposing of hazardous waste from these processes.

4.2.2.3 Plasma Treatment

The gas plasma treatment of plastics involves exposing the plastic to a gas activated by radiofrequency energy. Materials exposed to this 'cocktail' of ions, electrons, free radicals and ultraviolet energy are cleaned and made receptive to adhesives. Oxygen plasma treatment of polyethylene appears to remove weak boundary layers and oxidise the surface leading to several-fold increases in bond strength with adhesives such as urethanes and epoxies.

Ammonia plasma treatment of polyethylene gives strong bonds with cyanoacrylate adhesives coupled with excellent strength retention upon water immersion (367). It is argued that covalent bonding between the surface amine groups and the cyanoacrylate is more resistant to the water than physical bonding alone.

Gas plasma is a relatively clean process with no hazardous by-products and can be automated, although capital and operating costs have traditionally been high. However, new equipment such as Openair™ plasma technology (www.plasmatreat.com) is allowing cost effective treatments.

4.2.2.4 Other Surface Treatments

The fluorination of polyolefins is a well established, though expensive, batch process often used to treat containers to give resistance to hydrocarbon solvents. German authors (386) have reported that fluorination of polypropylene and polyethylene gives a six-fold increase in peel strength when bonded to steel with a two-part epoxy adhesive. Evidence was presented which indicated covalent bond formation between the fluorinated surface and the amine component of the epoxy hardener.

Other treatments that have been reported to enhance adhesion of polyolefins are:

- contact with phosphorus trichloride in combination with UV radiation (420),
- electrical discharge (385) and
- excimer laser treatment (307, 419).

4.2.2.5 Polymer Modification

Several attempts have been made to dramatically alter either the surface or bulk properties of polyolefins in order to increase the surface energy or make them more polar.

Several studies deal with grafting of polar monomers to the polyolefins. The photografting of methacrylic acid, acrylic acid, acrylamide and methacrylamide onto polyethylene indeed gave polymers with improved adhesive strength (435), although a distinct trade-off was that the bond lines became hydrophilic and more susceptible to degradation by water.

Other approaches have been to graft itaconic acid to polypropylene (425) and polyethylene (243), acrylic acid to polyethylene after corona treatment (426), maleic anhydride to polypropylene (248, 430), acrylamide to polypropylene after electrical discharge treatment (350) and the bulk heterogeneous grafting of methyl methacrylate onto polypropylene powder (a.9).

All these studies claim significant improvements in bond strengths, although most of the treatment procedures would be extremely cumbersome to carry out on a commercial scale.

4.2.2.6 Surface Primers

All methods of pretreating or modifying low energy polymers prior to bonding are inconvenient, time consuming and often expensive. The use of a surface primer, although still somewhat inconvenient, is a much more desirable alternative which can be used on a production line.

Cyanoacrylates are widely used in product assembly operations worldwide because of their one-component nature, speed of cure and versatility. However like most other adhesives, low strengths on untreated polyolefins has precluded their use in many operations. A significant breakthrough was the discovery by Loctite Corporation that certain surface primers can give considerable enhancements to adhesive strength (423). These primers are not used to pretreat the polyolefins but are simply sprayed or brushed on to the substrate prior to applying the adhesive. Dilute solutions of trialkyl amines, trialkylammonium carboxylates, tetraalkylcarboxylates or ethylene diamine derivatives are applied to polypropylene or polyethylene substrates and the solvents allowed to evaporate. The substrates are then assembled with cyanoacrylate adhesive. All primers give increased bond strengths and the

trialkylammonium carboxylates give bonds so strong that failure occurs in the polyolefin substrates (shear strengths of over 7 MPa are consistently obtained).

Other companies have discovered primers that behave in a similar manner with cyanoacrylates. Henkel (a.10, a.11) has patented the use of imidazole derivatives and claims that bond strengths increase the longer the primer is left in contact with the substrate, prior to application of the adhesive, in contrast to earlier primers.

Toa Gosei (a.12) has examined primers comprising solutions of imidazole compounds in combination with chlorinated polypropylene or methylmethacrylate/chloroprene copolymers. Koatsu Gas (a.13) has patented solutions of triethylphosphine and tri-*N*-propyl phosphine.

Although Loctite and the other companies clearly demonstrated the efficacy of these primers, the underlying chemical or physical reasons for their usefulness are not clear, beyond the fact that Loctite found that the wetting of the adhesive on the substrates is not affected by the presence of the primer (423).

University researchers (431) have studied the interaction between solutions of two primers, *viz.*, triphenyl phosphine and cobalt acetylacetonate, and polyolefin surfaces in order to better understand why these primers promote adhesion using cyanoacrylates. These primers produce bonds that exceed the strength of the plastics and also have good resistance to immersion in hot water. The dependence of adhesive performance on the solvent, primer thickness, age of the primed surface and the durability of the bond were explained by a model where the primer dissolves in the surface of the plastic and facilitates interpenetration of the cyanoacrylate. The primer initiates polymerisation of the cyanoacrylate leading to entanglement of the polycyanoacrylate and polyolefin chains. A significant finding in this work was that maximum performance is obtained when solvents for the primers are chosen which will both wet out on and swell the polyolefin. Such solvents have solubility parameters close to that of the polyolefin and critical surface tensions lower than the polyolefin.

Further credence is lent to this interpenetration theory when a similar effect was observed using a free-radically cured acrylic adhesive system (359). In this system the primer consisted of a solution of a copper (II) salt and the adhesive was based on methyl methacrylate monomer with a small amount of trifunctional monomer and a hydroperoxide/amine

based cure system. It was found that bonds formed on low-density polyethylene result in substrate failure and that an interphase of mixed adhesive and polyethylene is formed up to 1.5 mm thick.

3M have recently introduced two-part reactive acrylic adhesives that can bond many low surface energy plastics, including many grades of polypropylene, polyethylene, and thermoplastic olefinic elastomers (TPOs) without special surface preparation (73, 139, a.14, a.15). These are tough adhesives with good tensile shear strengths on a wide range of substrates plus peel strengths of 28-32 N/cm. These adhesives also bond well to metals such as steel and aluminium. The major limitation of these adhesives appears to be their cure time, with time to reach handling strength being 2 to 3 hours at room temperature and full cure in 8 to 24 hours - although heat can accelerate the reactions. **Table 5** shows typical data obtained with these adhesives.

4.3 Bonding of Glass and Ceramics

Adhesive bonding of glass is usually much more desirable than using mechanical fastening and gives bonds with good appearance and low stress points.

Glass is usually bonded either to itself or to metals. The most common adhesives used are polyurethane, epoxy and UV acrylics.

Table 6 shows some typical applications of adhesives for glass bonding.

The largest single application for glass adhesives is the use of polyurethane adhesives for the OEM and aftermarket installation of automotive windshields and other stationary glass windows. The new steel panels used in vehicles are not as heavy as in older cars but being thinner, are not as strong. The use of polyurethane windshield adhesive/sealants to replace the traditional butyl sealants has enabled the windshield to become a structural part of the vehicle as it supports the roof. OEM adhesives are typically one-component moisture cured urethanes that take several hours to cure and give bonds with tensile shear strengths of 5 to 8 MPa. Aftermarket adhesives use two-part urethanes to speed up the repair process. Sika has recently developed repair products that can cure reliably to a safe strength in 30 minutes (42).

For applications requiring optically clear adhesives, the UV cured acrylics have been a major development.

Table 5 3M data on their structural plastic adhesive

Substrate	Overlap tensile shear strength, MPa	Failure mode
Extruded polyethylene (PE)	6.9	Substrate
Extruded polypropylene	7.2	Substrate
Ultra high molecular weight polyethylene	5.3	Substrate
Low density polyethylene	2.3	Substrate
ABS	6.7	Substrate
Polycarbonate	5.9	Substrate
PMMA	5.6	Substrate
Rigid PVC	10.6	Substrate
Polystyrene	3.8	Substrate
Nylon 6,6 (30% glass filled)	5.7	Cohesive
FRP	16.3	Cohesive
Galvanised steel to PE	6.8	Substrate (PE)
Steel to PE	6.7	Substrate (PE)
2024 Aluminium	14.8	Cohesive
Oily steel (galvanised)	14.8	Cohesive

Table 6 Examples of glass bonding applications	
Application	Typical adhesive
Automotive windshield installation	Polyurethane
Stemware manufacture	UV acrylic
Art glass	UV acrylic
Figurines	UV acrylic
Medical devices	Epoxy or UV acrylic
Optical lenses and parts	Epoxy or UV acrylic
Consumer glass repair	Epoxy or UV acrylic
Automotive rear view mirrors	UV acrylic
Auto windshield repair	UV acrylic
Display panels	UV acrylic
Syringe assembly	Epoxy or UV acrylic
Optical fibre bonding	UV acrylic

These adhesives are widely used in the manufacture of stemware, bonding rear view mirrors and the general assembly and repair of glass objects.

Adhesives are also used widely in the manufacture of glass and metal assemblies used in medical devices. Adhesives that are used for devices that may contact the bloodstream need to withstand sterilisation procedures - ethylene oxide, gamma ray or steam autoclaving. For reusable devices, the ability to pass through multiple autoclaving cycles without losing bond strength is the ultimate test of an adhesive. Epoxy adhesives perform well in autoclave cycles while other adhesives like cyanoacrylates or UV acrylics sometimes lose strength dramatically.

Needle bonding has long been a major application for adhesives. The bonding of stainless steel needles in glass syringes that are pre-filled with pharmaceuticals was traditionally done using heat-cured two component epoxies, but toughened UV acrylic adhesives have led to dramatic increases in productivity.

Ceramics can often be bonded with epoxy or acrylic adhesives, but there are limitations in their use at high temperatures. Few organic adhesives can perform above 250 °C, and inorganic adhesives have been developed for ceramics which offer a service temperature of over 2000 °C. These are based on

inorganic binding compounds such as sodium silicates and various metal phosphates, with carbon, alumina, silica, magnesia or zirconia powder fillers. Ceramic adhesives can be formulated into one-part or two-part systems and are often supplied as a water based binder solution and ceramic filler, which are mixed into a slurry for application as adhesives or sealants. Suitable selection of the binder and, more importantly, the filler, allows the coefficient of thermal expansion of the adhesive to be matched to that of a substrate to minimise stresses during heating and cooling.

One-component adhesives will cure slowly by drying or can be heated to speed up the process. Versions where cure is accelerated by atmospheric moisture are also available.

Weaknesses of inorganic adhesives include brittleness, sensitivity to moisture, and often lower adhesive strength than their organic counterparts.

Typical applications for these adhesives are bonding ceramics to metals in heaters, lamps and furnaces.

5 Durability of Adhesively Bonded Structures

The long-term durability of adhesively bonded structures is critical in determining their utility in replacing mechanical fastening systems. The achievement of high static shear strengths in bonded joints does not necessarily translate to good performance under load, particularly under dynamic loading conditions and aggressive environments (320, 324, 333).

Several studies have attempted to correlate adhesive strength tests with fatigue life or long-term durability, including finite element analysis (33), wedge testing (34), static loading of joints (36, 328), and variable amplitude fatigue testing (35). Water is known to be a major factor leading to the degradation of adhesive joints and can affect both the bulk adhesive and the adhesive/substrate interface (165). The durability of galvanised steel to fibreglass joints bonded with polyurethane adhesives and exposed to moisture was shown to be dependent on the type of fillers used in the adhesive, with PVC/clay fillers giving the most durable bonds (68). Increasing the loading of fillers in epoxy adhesives leads to enhanced environmental durability (326, 417). A critical combination of temperature, humidity and load was shown to cause

rapid loss of joint strength of steel specimens bonded with epoxies or polyurethanes (98). Shah, Lang and Liechti (250) have shown that fracture in adhesively bonded joints in fibreglass components is mixed-mode in nature, involving a combination of tensile and shear induced failure.

5.1 Surface Treatments for Metals

The ability to clean and prime metals with environmentally compliant and friendly chemicals is being studied in all industries to maximise adhesive strength and enhance long-term durability.

Corrosion has been the major factor causing joint failure in the aerospace industry and this is still an issue facing potential industrial and automotive users, particularly when metals like steel or copper are used (429). Japanese researchers (261) have shown that acid treatment of steel does not improve the fracture toughness of bonds with toughened epoxies, but it does increase the fatigue growth crack resistance by changing the locus of crack initiation from the adhesive-metal interface to the bulk adhesive itself. Chinese work has demonstrated the utility of anticorrosive polymer coatings on steel as improvements over phosphating when bonding with epoxy adhesives (267). Plasma spraying of Ni-Cr and Ni-Cr-Zn onto steel has been shown to produce environmentally durable bonds with epoxy adhesives (334). Chinese researchers have treated copper with aminosilanes prior to bonding with epoxies and shown a large increase in resistance to salt solutions, which is attributed to a reinforcement of the metal/adhesive interface due to coordination between the copper and the amino groups in the silane (290).

In the aerospace industry, aluminium and alloys are common and there are essentially two steps used to prepare these surfaces for bonding, namely, an etching or anodisation process to maximise adhesive strength and a priming process to prevent corrosion of assembled joints.

For aluminium alloys, there are three common surface preparation techniques utilised for aerospace applications:

- The Forest Products Laboratory (FPL) etching procedure utilising chromic-sulfuric acid.
- The Phosphoric Acid Anodization (PAA) process utilising phosphoric acid solutions. This was

originally developed by the Boeing Company and is the treatment of choice for critical applications in the US.

- Chromic Acid Anodization (CAA) is widely used to improve the corrosion protection of bare aluminium surfaces such as in window frames and other architectural applications. It is also the most common pretreatment process used for aerospace bonding in Europe (32).

Primers are typically organic solvent based solutions of epoxies or phenolic adhesives (377) and provide several major functions, among which are:

1. Protecting a chemically prepared surface during storage and handling,
2. Provide protection against corrosion inside and outside of bond lines,
3. Provide a surface which is easily bonded to by adhesive films,
4. Provide protection against chemicals and be able to transfer loads from the aluminium substrate to the adhesive.

Davies and co-workers (413) described the improvement in adhesive bonding of aluminium alloys by anodising prior to bonding. The work showed that the morphology of the oxide and penetration of the adhesive into the porous oxide strongly influences bond performance.

Brewis and Critchlow (296) have investigated the locus of failure of aluminium joints bonded with epoxies and polyurethanes and tested in peel after water immersion. Significant differences were found between different surface treatment techniques, which included phosphoric anodisation, chromic acid treatment and epoxy primers.

Recently there has been a shift away from chemical intensive and toxic processes. Several air forces have developed abrasion processes that include the application of silane coupling agents to prepare non-ferrous surfaces for adhesive bonding. These processes (a.16, a.17), which are directed mainly at field level repair, offer many advantages such as low toxicity materials and fairly simple procedures. Boeing Corporation (a.18) and Dexter (a.19) have described the testing of low VOC primers. Silanes have become widely accepted as primers in several adhesive systems

to prevent degradation of bonded joints due to the ingress of water (29, 30, 31, 96, 195). These molecules contain hydrophilic and hydrophobic moieties and act as a coupling system between organic adhesives and metal or glass surfaces. In addition to enhancing adhesion, they provide resistance to hydrolytic degradation of adhesive bonds. The rate of hydrolysis of the primers on metal surfaces and catalysis by tin salts has been studied (101, 111).

However, silanes must be chosen carefully for each adhesive system. For example, in a study on the effectiveness of silanes as primers for the bonding of aluminium alloys with epoxies (27), it was found that bis(triethoxysilyl)ethane increased the durability of bonds exposed to acidified salt spray by decreasing the hydrolysis and/or corrosion at the metal-adhesive interface whereas gamma-aminopropyltriethoxysilane increased the strength of the bond but increased the corrosion rate, leading to bond failure. Other authors have shown that gamma-glycidoxyaminopropyltrimethoxysilane increased the fracture energy of epoxy bonds after exposure to water (28).

Alcoa researchers (378) have investigated the bonding of aluminium alloys to steel for potential use in automobile body panels. In this study, lap shear and peel specimens were prepared and treated under processing conditions currently used for steel designs. Aluminium substrates were prepared by vapour degreasing and alkali cleaning. The steel substrates were cleaned by wiping with methyl ethyl ketone solvent. Following the cleaning steps, a water based forming lubricant was applied to the aluminium and the same lubricant or an anti-corrosion oil was applied to the steel. Stiffeners were attached to the specimens to eliminate bowing caused by the difference in thermal expansion coefficients between the two metals. Following assembly with adhesive and curing, the assembled panels were zinc phosphated and electrocoated, which are established procedures for steel surfaces to provide corrosion resistance and improve paint adhesion respectively. Adhesives studied were a wide range of epoxy, toughened epoxy, epoxy-urethane and tough acrylics. Joint strengths of specimens were measured at room temperature and at 100 °C, after immersion in common salt solutions and after exposure to 100% relative humidity conditions for periods of up to 60 days. Long-term outdoor exposure was also carried out. Many adhesives give lap shear strengths of over 14 MPa when tested at room temperature and peel values of 70-175 N/cm. However testing at 100 °C began to show dramatic differences between adhesives. At this temperature we expect to see both the effects of softening of the adhesive itself

and the results of internal stresses set up by the differences in thermal expansion coefficients of the metals. All of the adhesives showed significant decreases in shear strength with only four retaining strengths greater than 10.5 MPa. Humidity was by far the harshest environment for the specimens. Many of the adhesives did not survive the duration of the test and peel strength decreased significantly in both the humidity and immersion testing. Only two adhesives, a toughened epoxy and an epoxy-urethane, retained strength with all three alloys and under all environmental conditions.

A significant finding from this work was that there was no evidence of galvanic corrosion in the specimens, either in the accelerated testing or in the long-term exposures after one year. It is encouraging that bonds involving aluminium substrates appear to be less susceptible to environmental damage than those with steel, because this is a factor that has limited the use of structural adhesives on steel. Indeed, Pocius and co-workers (a.20) showed that in comparing the bond durability of steel and aluminium, dry lap-shear strengths can be similar but stressed lap-shear joints of steel substrates that are exposed to a humid environment fail in less than 30 days while the aluminium joints last for more than 3000 days.

Swedish researchers (327) have investigated relatively simple surface treatments for aluminium with the goal of discovering what level of treatment is necessary to survive various environments. They found that the more corrosion resistant low strength alloys can often be treated by simply degreasing or brushing when exposed to less severe environments like indoor applications, but in severe climates or for water immersion, then primers or anodisation are critical, particularly with high strength, less corrosion resistant alloys. Elbing and co-workers studied the surface pretreatment of aluminium components by dry ice blasting as well as a process optimisation for the enhancement of the adhesive strength of industrial epoxy and polyurethane adhesives on aluminium surfaces (12). They found increases of adhesive strength by up to 99% for epoxy and 27% for polyurethane compared to the untreated surfaces. Other environmentally-friendly pretreatment methods include treatment of aluminium with excimer laser (209), CO₂-laser (280, 340), electric arc treatment (277) and cryoblasting (a.21). The subject of surface treatment and long-term durability of adhesively-bonded aluminium has been reviewed (46, 58, 280). Plasma spraying of inorganic powders onto aluminium and titanium surfaces has been shown to be equivalent to chemical treatments in enhancing the durability of adhesive bonds (299, 366).

5.2 Testing and Inspection of Adhesive Bonds

The most commonly used methods for adhesive bond evaluation are mechanical tests such as tensile shear and peel tests that determine the weakest link in a bonded assembly. Although these tests are useful in adhesive development and quality control, they are destructive and cannot offer failure prediction for in-service components. Ultrasonic inspection is the most commonly used non-destructive test method and can accurately assess debonding in single adhesive bonds, providing the sensor is perpendicular to the defect plane. However, ultrasound does have some limitations in multilayered specimens and when the sensor cannot be aligned easily. Guide wave technology has been described for evaluation of bonds in curved aircraft surfaces (355). Jagasivamani and Smith (a.22) have measured the acoustic properties of adhesive bonds under stress and can detect poor and good bonds by the influence of their stress sensitive properties on the acoustic wave time-of-flight and by temperature changes within the adhesive. One promising ultrasonic technique, angle-beam reflection has been used to study the environmental degradation of adhesive joints (a.23). It was found that this technique allowed a distinction to be made between degradation of the bulk adhesive and failures at the adhesive/adherend interface. Laser-induced ultrasound has been shown to be able to detect defects in bonded joints (143).

The Australian Defence Force Academy has used holographic interferometry (360), to detect weakly bonded joints due to bond line surface or adhesive degradation. Other researchers have used dielectric spectroscopy to investigate the rate of water or solvent ingress into composites or metals bonded with epoxies and correlated this with the loss of strength of the bonds (22, 23, 24, 26, 37, 92, 183, 283, 298, 368). Neutron radiography has been shown to be able to detect defects in steel substrates bonded with epoxies (25). DC-resistance measurements have been used to determine the stages of degradation in steel joints bonded with epoxies (371). Small spot X-ray photoelectron spectroscopy can detect bond defects and verify the mechanism of delamination (41).

Automotive companies have used a 4-poster road simulator rig with environmental conditioning to establish correlations with conventional adhesive testing methods (69).

6 Applying and Curing of Adhesives

Adhesives can be applied as shots and beads, roll coated, or sprayed. Application equipment ranges from simple bottles and tubes to sophisticated robotic automatic systems. The simplest application techniques are airless spraying or roll coating - these are used frequently in the bonding of large panels, e.g., structural insulated panels or insulated garage doors. However, most adhesives need to be applied in small amounts and with some precision. This can be done with manual applicators such as syringes or cartridges or can be automated.

Important factors to consider when choosing dispensing equipment include:

- Nature of the product - single or dual component.
- Viscosity and rheology.
- Precision required during application.
- Possible interaction of the product with materials in the dispenser.
- Pot life issues in the dispenser due to heat or atmospheric contamination.

In general, one-component materials are the easiest to handle but there are several potential problems that may arise, e.g.,

- Anaerobic adhesives should be kept in contact with atmospheric oxygen to maximise pot life and care should be taken to exclude transition metals in the dispensing lines and valves, which can act as accelerators for the adhesives. Stainless steel and polyethylene are usually the best materials for dispensing lines and pots.
- Hot melt polyurethane dispensers must be purged with dry air or nitrogen to prevent premature curing and since their viscosities tend to increase rapidly on prolonged storage at high temperatures, this must be checked frequently and appropriate timers or temperature controllers should be installed to prevent overheating during line shutdowns.
- Cyanoacrylates are quite sensitive to acidic or basic impurities and their stability and reactivity should be checked after storage in dispensers. Clean up

can often be a problem with cyanoacrylates where the adhesive often cures in, for example, drip trays or on the outside of joints. Precise application is the best solution - otherwise disposable drip trays or trays coated with PTFE should be used.

- Seals in equipment can be swollen, destroyed or bonded by many types of adhesives. Usually, constructing seals from high performance materials like PTFE or fluoroelastomers will mitigate these problems.

Two-component adhesives and sealants have some similar potential handling problems, e.g.,

- Epoxy adhesives are sometimes highly filled with abrasive particles, which must be taken into account in the design of dispensers and seals.
- Two-component urethanes are very sensitive to contamination by moisture, which can cause premature curing or gas bubbles in the adhesive.

Two-component materials can be premixed and applied within the specific pot life of the mixed material or can be stored separately and then be metered and mixed. In recent years many types of two-component syringes and cartridges have become available with varying mix ratios and fitted with static mixing nozzles.

Fully automated systems are available for both one- and two-component adhesives and sealants, and there are a number of different options, degrees of sophistication and price levels.

An automated system comprises several elements, *viz.*:

Delivery system - Materials can be supplied in bulk in pails or drums, large totes or tanks, or in small containers that include cartridges, syringes or cans. Depending mainly on the viscosity of the material, a delivery system can use gravity feed or be pressurised. Peristaltic pumps, gear pumps or progressing cavity pumps (4) can also be used for delivery.

Metering - The materials are applied by measured volume shots. The most common metering systems are positive displacement piston fillers and timed shot dispensers.

Mixing - Mixing of two-component materials can be done using a static (sometimes called motionless) mixer where the materials are forced through a series of right-

and left-handed helical elements at 90 degrees with no moving parts. Dynamic mixers are also available that use high shear to mix the two components. Pin/blade and helical designs are common and plastic mixers with rotating mix elements have become common in recent years.

Dispensing - Valves range from simple ball valves to pinch valves and needle valves. The 'suck-back' or snuffer valve is invaluable for dripless dispensing. The liquid flow commences on the forward stroke of the valve spool. When the spool retracts, a vacuum is created and an adjustable, dripless snuff-back occurs at the dispense-nozzle outlet.

Automation - Automation offers many benefits from increased production rates, accuracy and consistency to decreased labour costs. Most automated systems still use indexing rotary tables or conveyors and apply adhesives and sealants using a 'Z' lift to move the dispense valve vertically to a preset height. Once the valve is elevated, a new part is indexed under the valve nozzle, the valve is lowered and dispensing starts. Programmable XYZ tables can handle applications requiring several different dispense patterns. The most sophisticated motion device is a multi-axis robot and these are now being used quite widely in a range of industries (67).

Ford and 3M have recently developed a novel method of controlling the mix ratio of two-part epoxy adhesives by measuring it continuously using a tagging system that incorporates microscopic stainless steel-coated glass bubbles in one component of the adhesive (49). These can then be detected by two eddy current sensors integrated into the dispensing equipment. The technique enables 100% knowledge and 100% control of the dispense ratio. Image processing systems are being used to perform a continuous optical check on the application of adhesives (74).

After application, most structural adhesives cure at room temperature with full cures taking hours to several days. Curing can be accelerated by heating in batch or continuous ovens, by microwave curing (346) or by induction heating (260, 317). The strength of hub/shaft joints bonded with acrylic and epoxy adhesives was found to increase when curing was carried out at high hydrostatic pressures (95). A novel method of removing the necessity for clamping of parts during curing has been reported (271), which involves using a self-adhesive tape to hold parts together and to create a channel for subsequent injection of the liquid adhesive.

7 Standards for Adhesives

Many standards have been developed over the years for the testing and quality control of adhesives. These range from international standards, to military specifications, aerospace, and individual company material and performance standards, such as those used by automotive manufacturers.

For many years industry has made use of military or defence standards. These were developed by government departments, in conjunction with industrial suppliers, in many countries to specify performance and quality requirements for defence procurement, and they have often provided a reliable and readily available standard for other industrial users. They have also been subject to international harmonisation, primarily through NATO. For example, many anaerobic threadlockers were originally developed to meet US military specifications and these are still the most widely used specifications. There is now a trend for defence organisations to use industrial standards.

Standardisation of adhesives is done on an international, regional and national basis and there is considerable activity in trying to harmonise standards on an international basis. The most important industrial standards are ISO standards, European standards and ASTM standards.

7.1 ISO Standards

The International Organization for Standardization (ISO) has recognised regional standards organisations representing Africa, the Arab countries, the area covered by the Commonwealth of Independent States, Europe, Latin America, the Pacific area, and the South-East Asia nations. These recognitions are based on a commitment by the regional bodies to adopt ISO standards - whenever possible without change - as the national standards of their members and to initiate the development of divergent standards only if no appropriate ISO standards are available for direct adoption.

Table 7 shows relevant ISO standards for structural adhesives.

7.2 European Standards

European standards are published by the 'CEN European Committee for Standardization' (www.cenorm.be). Standards are available covering performance specification, quality control, methods of

test, methods of use and surface preparation. Originally developed as national standards, the needs of the single market, globalisation, and international trade have resulted in a gradual alignment with European (EN) and international (ISO) standards. Whenever a CEN standard is introduced it must, under European rules, replace any existing national standard. This harmonisation, which is still in progress, has meant a great deal of drafting, consultation and compromise by industry specialists from all the relevant countries.

Table 8 shows relevant published European Standards (EN). There are also European Pre-Standards (ENV) and European/International Standards (EN ISO) on structural adhesives.

7.3 ASTM Standards

In the US, the American Society for Testing and Materials (ASTM) publishes standards relevant to structural adhesives (**Table 9**).

8 Health and Safety Issues

Many health and safety issues with adhesives have been mitigated with the movement away from solvent based systems. Some activators and primers are still solvent based but have been changed from chlorinated solvents to safer ones such as alcohols, acetone and hydrocarbons. Some reactive acrylic activators are used undiluted or dissolved in monomers.

However, there are still some concerns, even with 100% solids systems. Examples are:

- Epoxy hardeners - some amines are quite toxic.
- Cyanoacrylates - highly irritant vapours.
- Polyurethanes - some isocyanates in these systems are irritating and toxic.
- Anaerobics - a small percentage of people can suffer skin sensitisation.
- Reactive acrylics - systems based on methyl methacrylate have noxious irritating odours and are highly flammable.
- Reactive hot melt polyurethanes - danger of burns from molten adhesive.

Table 7 ISO standards for adhesives	
ISO 4578:1997	Adhesives – Determination of peel resistance of high-strength adhesive bonds – Floating-roller method
ISO 4587:2003	Adhesives – Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies
ISO 4588:1995	Adhesives – Guidelines for the surface preparation of metals
ISO 6922:1987	Adhesives – Determination of tensile strength of butt joints
ISO 7387-1:1983	Adhesives with solvents for assembly of PVC-U pipe elements – Characterization – Part 1: Basic test methods
ISO 8510-1:1990	Adhesives – Peel test for a flexible-bonded-to-rigid test specimen assembly – Part 1: 90 degree peel
ISO 8510-2:1990	Adhesives – Peel test for a flexible-bonded-to-rigid test specimen assembly – Part 2: 180 degree peel
ISO 9142:1990	Adhesives – Guide to the selection of standard laboratory ageing conditions for testing bonded joints
ISO 9311-2:2002	Adhesives for thermoplastic piping systems – Part 2: Determination of shear strength
ISO 9653:1998	Adhesives – Test method for shear impact strength of adhesive bonds
ISO 9664:1993	Adhesives – Test methods for fatigue properties of structural adhesives in tensile shear
ISO 10123:1990	Adhesives – Determination of shear strength of anaerobic adhesives using pin-and-collar specimens
ISO 10354:1992	Adhesives – Characterization of durability of structural-adhesive-bonded assemblies – Wedge rupture test
ISO 10363:1992	Hot-melt adhesives – Determination of thermal stability
ISO 10364:1993	Adhesives – Determination of working life (pot life) of multi-component adhesives
ISO 10365:1992	Adhesives – Designation of main failure patterns
ISO 10964:1993	Adhesives – Determination of torque strength of anaerobic adhesives on threaded fasteners
ISO 11003-1:2001	Adhesives – Determination of shear behaviour of structural adhesives – Part 1: Torsion test method using butt-bonded hollow cylinders
ISO 11003-2:2001	Adhesives – Determination of shear behaviour of structural adhesives – Part 2: Tensile test method using thick adherands
ISO 11339:2003	Adhesives – T-peel test for flexible-to-flexible bonded assemblies
ISO 11343:2003	Adhesives – Determination of dynamic resistance to cleavage of high-strength adhesive bonds under impact conditions – Wedge impact method
ISO 13445:2003	Adhesives – Determination of shear strength of adhesive bonds between rigid substrates by the block-shear method
ISO 13895:1996	Adhesives – Guidelines for the surface preparation of plastics
ISO 14615:1997	Adhesives – Durability of structural adhesive joints – Exposure to humidity and temperature under load
ISO 14676:1997	Adhesives – Evaluation of the effectiveness of surface treatment techniques for aluminium – Wet-peel test by floating-roller method

Table 7 Continued...	
ISO 14679:1997	Adhesives – Measurement of adhesion characteristics by a three-point bending method
ISO 15107:1998	Adhesives – Determination of cleavage strength of bonded joints
ISO 15108:1998	Adhesives – Determination of strength of bonded joints using a bending-shear method
ISO 15109:1998	Adhesives – Determination of the time to rupture of bonded joints under static load
ISO 15166-1:1998	Adhesives – Methods of preparing bulk specimens – Part 1: Two-part systems
ISO 15166-2:2000	Adhesives – Methods of preparing bulk specimens – Part 2: Elevated-temperature-curing one-part systems
ISO 15509:2001	Adhesives – Determination of the bond strength of engineering-plastic joints
ISO 15605:2000	Adhesives – Sampling
ISO 15908:2002	Adhesives for thermoplastic piping systems – Test method for the determination of thermal stability of adhesives

Table 8 European standards for adhesives	
EN 828 : 1998	Structural adhesives – Wettability – Determination by measurement of contact angle and critical surface tension of solid surface
EN 1464 : 1995	Adhesives – Determination of peel resistance of high-strength adhesive bonds – Floating roller method
EN 1465 : 1995	Adhesives – Determination of tensile lap-shear strength of high-strength adhesive bonds
EN 1965 : 2001	Structural adhesives – Corrosion Part 1: Determination and classification of corrosion to a copper substrate Part 2: Determination and classification of corrosion to a brass substrate
EN 1966 : 2003	Structural adhesives – Characterization of a surface by measuring adhesion by means of the three point bending method
EN 1967 : 2003	Structural adhesives – Evaluation of the effectiveness of surface treatment techniques for aluminium using a wet peel test in association with the floating roller method
EN 12701 : 2001	Structural adhesives – Storage – Definitions of words and phrases relating to the product life of structural adhesives and related materials
EN 14173 : 2002	Adhesives – 180° peel test for materials
EN 26922 : 1993	Adhesives – Determination of tensile strength of butt joints
EN 28510 : 1993	Adhesives – Peel test for a flexible to rigid bonded assembly Part 1: 90° peel Part 2: 180° peel

Table 9 ASTM standards for adhesives	
D896-97	Standard Test Method for Resistance of Adhesive Bonds to Chemical Reagents
D897-01	Standard Test Method for Tensile Properties of Adhesive Bonds
D903-98	Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
D1002-01	Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
D1062-02	Standard Test Method for Cleavage Strength of Metal-to-Metal Adhesive Bonds
D1151-00	Standard Practice for Effect of Moisture and Temperature on Adhesive Bonds
D1183-03	Standard Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions
D1184-98	Standard Test Method for Flexural Strength of Adhesive Bonded Laminated Assemblies
D1304-99	Standard Test Methods for Adhesives Relative to Their Use as Electrical Insulation
D1780-99	Standard Practice for Conducting Creep Tests of Metal-to-Metal Adhesives
D1781-98	Standard Test Method for Climbing Drum Peel for Adhesives
D1876-01	Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
D1879-99	Standard Practice for Exposure of Adhesive Specimens to High-Energy Radiation
D2094-00	Standard Practice for Preparation of Bar and Rod Specimens for Adhesion Tests
D2095-96 (2002)	Standard Test Method for Tensile Strength of Adhesives by Means of Bar and Rod Specimens
D2293-96 (2002)	Standard Test Method for Creep Properties of Adhesives in Shear by Compression Loading (Metal-to-Metal)
D2294-96 (2002)	Standard Test Method for Creep Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal)
D2295-96 (2002)	Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading at Elevated Temperatures (Metal-to-Metal)
D2557-98	Standard Test Method for Tensile-Shear Strength of Adhesives in the Subzero Temperature Range from -267.8 to -55 °C (-450 to -67 °F)
D2651-01	Standard Guide for Preparation of Metal Surfaces for Adhesive Bonding
D2674-72 (1998)	Standard Test Methods for Analysis of Sulfochromate Etch Solution Used in Surface Preparation of Aluminum
D2739-97	Standard Test Method for Volume Resistivity of Conductive Adhesives
D2918-99	Standard Test Method for Durability Assessment of Adhesive Joints Stressed in Peel
D2919-01	Standard Test Method for Determining Durability of Adhesive Joints Stressed in Shear by Tension Loading
D3165-00	Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading of Single-Lap-Joint Laminated Assemblies
D3166-99	Standard Test Method for Fatigue Properties of Adhesives in Shear by Tension Loading (Metal/Metal)
D3167-03	Standard Test Method for Floating Roller Peel Resistance of Adhesives
D3310-00	Standard Test Method for Determining Corrosivity of Adhesive Materials

Table 9 Continued...	
D3433-99	Standard Test Method for Fracture Strength in Cleavage of Adhesives in Bonded Metal Joints
D3482-90 (2000)	Standard Test Method for Determining Electrolytic Corrosion of Copper by Adhesives
D3528-96 (2002)	Standard Test Method for Strength Properties of Double Lap Shear Adhesive Joints by Tension Loading
D3658-01	Standard Test Method for Determining the Torque Strength of Ultraviolet (UV) Light-Cured Glass/Metal Adhesive Joints
D3762-03	Standard Test Method for Adhesive-Bonded Surface Durability of Aluminum (Wedge Test)
D3933-98	Standard Guide for Preparation of Aluminum Surfaces for Structural Adhesives Bonding (Phosphoric Acid Anodizing)
D4562-01	Standard Test Method for Shear Strength of Adhesives Using Pin-and-Collar Specimen
D4896-01	Standard Guide for Use of Adhesive-Bonded Single Lap-Joint Specimen Test Results
D5648-01	Standard Test Method for Torque-Tension Relationship of Adhesives Used on Threaded Fasteners (Lubricity)
D5649-01	Standard Test Method for Torque Strength of Adhesives Used on Threaded Fasteners
D5656-01	Standard Test Method for Thick-Adherend Metal Lap-Shear Joints for Determination of the Stress-Strain Behavior of Adhesives in Shear by Tension Loading
D5657-01	Standard Test Method for Fluid Tightness Ability of Adhesives Used on Threaded Fasteners

9 Future Trends

The increasing use of plastics and composites will continue to fuel the demand for high performance adhesives and they will continue to replace other methods of fastening. In particular:

- The increasing use of polyester SMC, other composites and light metals in automotive panels will increase demand for polyurethanes and epoxies.
- Better and faster curing adhesives for plastics like polyethylene and TPOs will lead to their increased usage.
- High performance two-part liquid and reactive hot melt urethanes will continue to expand their market share in automotive and in the bonding of large area panels.

The US trade association, The Adhesive and Sealant Council (ASC), has initiated a program called 'Building the Industry' with the goal of increasing the market for structural adhesives and sealants by identifying and developing opportunities to replace mechanical and other incumbent fasteners (www.ascouncil.org).

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Abbreviations and Acronyms

ABS	acrylonitrile-butadiene-styrene copolymer
ASC	Adhesive and Sealant Council
ASTM	American Society for Testing and Materials
CAA	Chromic Acid Anodization
CEN	Comité Européen de Normalisation
CTBN	carboxy terminated butadiene-acrylonitrile
DGEBA	diglycidyl ether of bishpenol A
DiCy	dicyandiamide
EN	European Norm
FPL	Forest Products Laboratory
FRP	fibre reinforced plastics
ISO	International Organization for Standardization
OEM	original equipment manufacturer
PAA	Phosphoric Acid Anodization
PE	polyethylene
PMMA	polymethylmethacrylate
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
RHMU	reactive hot melt polyurethane
SMC	sheet moulding compound
Tg	glass transition temperature
TPO	thermoplastic olefinic elastomer
UV	ultraviolet

Abstracts from the Polymer Library Database

Item 1

Adhesives & Sealants Industry

10, No.7, Sept.2003, p.51-7

INJECTING LIGHT CURE ADHESIVE

Salerni C M; Serenson J A

Henkel Loctite Corp.

Disposable needles make up a large percentage of the disposable medical device market. A wide variety of medical devices incorporate a needle or cannula, such as insulin syringes, hypodermic and angiographic needles and intravenous sets. Needle assembly can be quite challenging. The joint is small and cylindrical and typically joins a stainless steel cannula to a plastic hub. Adhesives deliver high strength, hermetically sealed bonds, simple processing and gap filling. Light cure technology has become the joining method of choice because of its fast cure and simple processing. Both acrylic and cyanoacrylate adhesives are available for light-cure applications.

USA

Accession no.895891

Item 2

International Journal of Adhesion & Adhesives

23, No.4, 2003, p.307-13

WARM WATER TREATMENT OF ALUMINUM FOR ADHESIVE BONDING

Underhill P R; Rider A N; DuQuesnay D L

Canada,Royal Military College; Australia,Aeronautical & Maritime Res.Labs.

Grit blasted aluminium alloys were immersed in warm water prior to coating with a silane solution and then bonded with an epoxy adhesive. The resulting adhesive joints were subjected to wedge testing and analysed using X-ray photoelectron spectroscopy and high-resolution scanning electron microscopy to determine the failure mechanism. The effect of treatment at 50C for 2, 10, 30 and 60 min. and at 40C for 10, 30 and 60 min on the wedge test performance of the samples was examined and an explanation given for the improvement in performance following water treatment. 14 refs.

AUSTRALIA; CANADA

Accession no.895144

Item 3

Adhasion Kleben & Dichten

47, No.6, 2003, p.38-40

German

QUALITY-RELATED ASPECTS FOR THE USE OF ADHESIVES TECHNOLOGY IN RAIL VEHICLE CONSTRUCTION

Preusser W; Gierl C; Tacker M

Austria,Research Institute for Chemistry and Technology

This article reviews the conditions that have to be met in order to fulfill all the requirements for applying adhesives technology to the mass production of rail vehicles so that it matches similar production for aircraft and cars. It looks at an organisational plan from the firm of Bombardier. New parts of rail vehicles are to be glued like front and side windows. Speed of assembly processes is examined through greater use of adhesives as well as a guarantee of quality.

BOMBARDIER

AUSTRIA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.892443

Item 4

Adhasion Kleben & Dichten

47, No.6, 2003, p.32-4

German

EXACT AND CONTINUOUS MIXING OF TWO-COMPONENT MATERIALS

Tytgat J-C

Netsch Mohnpumpen GmbH

Several thousand years ago our ancestors had already mastered the production and mixing of components in order to produce colours, for example. Experience, skill and sense of proportion came into question in order to attain a usable, reliable mixture. Today, in the era of automation, numerous mixing systems are on the market, in which, for example, piston pumps remove different components from containers and feed them to a mixing system. Then, cogwheel or piston pumps meter out the individual components to a static or dynamic mixer. Alternatively, a valve technique without any pumps can be used for this purpose. This article looks at a complete solution just on the market that takes on the tasks of emptying containers and metering out materials.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.892441

Item 5

Kunststoffe Plast Europe

93, No.3, 2003, p.51-3; p.A35-9

English; German

BONDING AUTOMOTIVE BODIES

Sauer J

Vantico AG

Plastics currently make up 13-18 % of a car. This is predicted to grow at an annual rate of 4.7% in the West European automotive industry. Plastics applications are distributed between the car interior, by far the greatest proportion, followed by body exterior parts, the engine compartment and electrical/electronics systems. New

plastics applications are mainly to be expected in the body, the part of the vehicle in which fibre composites are increasingly used. This is driven by the trend towards increased diversification and niche vehicles. Visible body panels of fibre-reinforced plastics (FRP) are most economical on vehicles produced in small production runs, where they could replace steel or aluminium. Fibre-reinforced plastics also offer relatively high strength and stiffness, combined with low weight. They are highly corrosion resistant and permit a high degree of freedom of design, which, if possible for metals, would be extremely expensive to achieve. Adhesive bonding is raising in importance as it often is the only suitable joining technology. Emphasis is placed on new adhesives for SMC components meeting maximum demands, and chemical thixotropic adhesives. 10 refs.

SWITZERLAND; WESTERN EUROPE

Accession no.889367

Item 6

Journal of Adhesion

78, No.11, Nov.2002, p.967-85

NONDESTRUCTIVE EXAMINATION OF EPOXY ADHESIVE-BONDED STRUCTURES EXPOSED TO A HUMID ENVIRONMENT: A COMPARISON OF LOW- AND HIGH-FREQUENCY DIELECTRIC MEASUREMENTS

Comrie R; Affrossman S; Hayward D; Pethrick R A
Strathclyde, University

The influence of moisture on thick film adhesively bonded lap-shear joints was investigated by means of broadband dielectric measurements at low and high frequencies. The joints were constructed from aluminium alloy bonded with a rubber-modified epoxy resin containing Ballotini glass spheres for controlling bondline thickness. The mechanical properties of the joints were also determined and fracture surfaces analysed by scanning electron microscopy. A correlation was established between variation of the dielectric permittivity and changes in the mechanical strength of the joints and a comparison made of low-frequency and high-frequency dielectric measurements. 25 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.888662

Item 7

Power at Work

Winter 2003, p.13-4

REACTIVE HOT MELTS FINDING A NEW HOME IN PANELS

Today, homeowners and architects can purchase double-paned windows that are twice as energy-efficient as those installed just 10 years ago. Foam core panels have consistently proven to be more energy efficient than walls built using traditional construction methods. Laminated panels are backing many of these energy efficiency

achievements and Rohm & Haas is dedicating much time, talent and resources to developing reactive hot melt adhesives for this application. Reactive hot melt technology facilitates very efficient manufacturing processes and also delivers incomparable heat resistance. Rohm & Haas moisture cure urethanes have demonstrated outstanding creep resistance in many applications for years. The company intends to offer the same creep resistance in its reactive hot melts.

ROHM & HAAS CO.

USA

Accession no.885957

Item 8

Power at Work

Winter 2003, p.4/6

ON A ROLL

As the recreational vehicle industry grows in size, technology and sophistication, Rohm & Haas adhesives keep pace. Recent advances in the Mor-Ad M series product line, used to bond sidewall, roof, door and baggage door panels, are enabling greater quality, productivity and dependability for these ever more elaborate vehicles. Mor-Ad M-660, a 100% solids moisture cure urethane, possesses several salient improvements over a predecessor, Mor-Ad M-640. Its lower viscosity lessens wear on machines and provides better adhesive coverage when a panel enters the press. The product demonstrates excellent heat resistance, vital when RV's visit hot areas like Texas. During manufacture, Mor-Ad M-660 is stable between 60-100F.

ROHM & HAAS CO.

USA

Accession no.885955

Item 9

Adhesive Joints: Formation, Characteristics and Testing, vol.2.

Utrecht, VSP BV, 2002, p.329-36, 25 cm, 6A1

DURABILITY OF STRUCTURAL ADHESIVES AND THEIR BONDED JOINTS FOR HIGH SPEED AEROSPACE APPLICATIONS

Parvatareddy H; Shuangyang X; Dillard D
Dow Chemical Co.; Virginia, State University

Edited by: Mittal K L

(VSP BV)

This study aims to evaluate the durability of structural adhesive joints for application in the proposed Mach 2.4 high speed civil transport aircraft. The criterion for selection is based on the bonded system exhibiting sufficient durability for over 60,000 hours in service environment conditions. Ti-6Al-4V/FM-5 bonds and neat resin samples were aged at 177 degrees C and 204 degrees C in one of three different environments: atmospheric air, and reduced air pressures of 2 psi and 0.2 psi. The adhesive used in the study was a polyimide. The bonded specimens and neat adhesive films

were conditioned in ageing ovens for 24 months and selected samples were periodically removed and tested at ageing times which were logarithmically separated, in order to measure the critical strain energy release rate as a function of temperature and environment. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; USA; WESTERN EUROPE

Accession no.885675

Item 10

Adhesive Joints: Formation, Characteristics and Testing, vol.2.

Utrecht, VSP BV, 2002, p.79-88, 25 cm, 6A1

**PHOTOCURING INDUCED ADHESION
EVOLUTION IN MARINE ENVIRONMENTS**

Dolez P I; Anderson R; Marek M; Love B J

Virginia, Polytechnic Institute & State University

Edited by: Mittal K L

(VSP BV)

A photo-polymerisable acrylic resin, based on a two-component mixture of bis-phenol-A-diglycidylether dimethacrylate (bis-GMA) with triethyleneglycol dimethacrylate (TEGDMA), was evaluated for underwater adhesion. The bulk maximum strength and flexural modulus, conversion extent, and adhesion strength of the resin was measured as a function of the curing time for underwater curing at several temperatures between 1 and 25 degrees C. It is found that the resin conversion progresses in an efficient and observable way while immersed in water even at cold temperature, and that the temperature of the water bath does not affect the cure evolution of the resin, and as such the candidate resin is claimed to be viable for use as an adhesive in marine environments. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; USA; WESTERN EUROPE

Accession no.885612

Item 11

The Polyurethanes Book.

Chichester, John Wiley & Sons Ltd., 2002, p.347-61.

27 cm. 43C6

**INTRODUCTION TO COATINGS, ADHESIVES,
SEALANTS AND ENCAPSULANTS**

Wilford-Brown J

Edited by: Randall D; Lee S

(Huntsman International LLC)

The global market for polyurethane-based coatings, adhesives, sealants and encapsulants is reported to be around 2.6 million tonnes. The market shares between the sectors are given, and show polyurethane coatings to be the largest share with 53.7%, followed by adhesives and binders with 28%. This chapter deals with the raw materials, surface interactions, test methods, and environmental issues and future trends.

WORLD

Accession no.885586

Item 12

International Journal of Adhesion & Adhesives

23, No.1, 2003, p.69-79

**DRY ICE BLASTING AS PRETREATMENT OF
ALUMINUM SURFACES TO IMPROVE THE
ADHESIVE STRENGTH OF ALUMINUM
BONDING JOINTS**

Elbing F; Anagreh N; Dorn L; Uhlmann E

Berlin, Technical University; Jordan, Al-Balqa Applied University

Aluminium surface were subjected to dry ice blasting and bonded with epoxy and PU adhesives. The effects of various parameters on the structure, roughness and chemical composition of the pretreated aluminium were investigated and the pretreatment method compared with other pretreatment methods. Single lap shear tension tests were performed on the adhesively bonded aluminium joints to determine bond strength and the structure and chemical composition of fracture surfaces were examined by scanning electron microscopy and energy dispersive X-ray analysis. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
JORDAN; WESTERN EUROPE

Accession no.885365

Item 13

Adhesives & Sealants Industry

10, No.3, April 2003, p.40-3

**REACTIVE, TOUGHENED ACRYLIC
ADHESIVES POISED FOR GROWTH**

Dunn D

bms North America Inc.

Reactive acrylics are well-established structural adhesives in a wide range of industries and compete with adhesives like epoxies and PUs. They are also called tough acrylics, toughened acrylics or second-generation acrylics (SGAs). However, these adhesives have never achieved the market penetration that many people anticipated. Several events indicate that significant growth may be expected for SGAs: key patents have expired or will expire shortly; greater availability of raw materials; dispersion of technical knowledge; and technical advancements in adhesives. 6 refs.

USA

Accession no.885275

Item 14

Medical Polymers 2003. Proceedings of a conference held Dublin, 2nd-3rd April 2003.

Shawbury, Rapra Technology Ltd., 2003, Paper 15, p.133-42, 29 cm, 012

**BONDING SOLUTIONS FOR THE MEDICAL
DEVICE INDUSTRY**

Byrne B

Henkel Loctite Adhesives Ltd.

(Rapra Technology Ltd.)

Coupled with the increasing demand for new devices, manufacturers are constantly reviewing their materials, designs and methods of production. Plastics, elastomers and metals of many types are used in these devices. Recent advances in the areas of UV curing acrylics, cyanoacrylates, epoxy and silicones, can offer significant benefits to the device manufacturer. The correct choice of adhesive is of course critical. However, its selection cannot be made in isolation from many other associated considerations, which are equally critical to the success of the device assembly. Factors including component design (e.g. materials, gaps), pre-treatment and cleaning methods used (e.g. solvent, aqueous), preferred assembly method (e.g. manual or automatic) quality specifications (e.g. appearance, strength, durability) and regulatory issues also need to be considered. Emphasis is placed on how the adhesive supplier can work with the device manufacturer to develop a total bonding solution approach to deliver an efficient and effective process. The unique needs of each device manufacturer can be met by the appropriate application experience of the adhesive supplier. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.884471

Item 15

Adhesives Age

46, No.2, March 2003, p.12-3

ROAD MORE TRAVELLED

Kalaygian M

Adhesive and sealant use within the automobile industry is on the rise. Auto makers are pursuing more aggressive designs to maximize space/structure with less weight and cost, resulting in the increased use of dissimilar materials. Some 258 million dry pounds of adhesives were shipped to the US automobile industry in 2000, generating 537m US dollars in revenues. That figure is forecast to grow 3%/year to reach 621m US dollars by 2005 and representing nearly 295 million dry pounds in shipments. One of the top uses of adhesives in automotive manufacturing is in the glass bonding area. Key areas of growth cited by industry experts include the use of structural foam adhesives within body cavities to absorb the energy of an impact, as well as increased efforts to reduce noise, vibration and harshness in order to provide more comfort in the cockpit.

WORLD

Accession no.881667

Item 16

Journal of Composite Materials

37, No.1, 2003, p.35-54

TIME- AND TEMPERATURE-DEPENDENT FAILURES OF A METAL-TO-COMPOSITES BONDED JOINT WITH PMMA ADHESIVE

MATERIAL

Sangwook Sih; Miyano Y; Nakada M; Tsai S W
Dayton, University, Research Institute;

Kanazawa, Institute of Technology; Stanford, University

A cast iron-GRP bonded joint with a PMMA adhesive material (Plexus AO425) was fabricated and tested under various loading conditions to aid in the short-term and long-term design of the bonded-jointed structures. The adhesive material was first characterised by measuring its creep compliance. The bonded joint was then tested under constant strain rate of uniaxial loadings as well as cyclic uniaxial fatigue loadings. The experiment was performed under several loadings and temperature conditions to understand failure mechanism and time- and temperature-dependency. Various dimensions of the specimens with three overlap lengths and three bondline thicknesses were used to study scaling sensitivity. Both tensile- and compressive-type loadings were used to examine loading sensitivity. 7 refs.

PLEXUS

JAPAN; USA

Accession no.881130

Item 17

Shawbury, Rapra Technology Ltd., 2003, pp.164, 30 cm, 176

ADHESIVES AND SEALANTS - TECHNOLOGY, APPLICATIONS AND MARKETS

Dunn D J

Rapra Technology Ltd.

This report covers the global technology ad markets for liquid, solid and film adhesives and sealants. It covers the basic chemistry of the manufacturing, formulating and curing of adhesives and sealants, including recent developments. It focuses on two important and inter-related end-user markets: Western Europe and North America, and also covers emerging growth markets in the Far East. Chapters are devoted to an overview of the markets, technology, materials, additives, classification and comparison of adhesives and sealants, applications and markets, consumption by global region and material type, industry structure and key players, international trends, and relevant associations.

WORLD

Accession no.880406

Item 18

Machine Design

75, No.3, 6th Feb.2003, p.62

GUIDE TO ENGINEERING ADHESIVES

General guidelines to the characteristics of various adhesives for engineering applications are presented. Adhesives considered include UV curable adhesives, epoxy adhesives, acrylic adhesives, anaerobic adhesives and cyanoacrylate adhesives. Reference is made to a new

16-page Engineering Adhesive Solutions Guide, which covers a broad range of adhesive chemistries and applications, from Permabond.

PERMABOND
USA

Accession no.880031

Item 19

RP Asia 2002: Composites in the global market. Proceedings of a conference held Kuala Lumpur, Malaysia, 5th-6th Sept.2002. Oxford, Elsevier Science Ltd., 2002, Paper 9, p.175-93, 29cm, 012

LARGE PART ASSEMBLY USING LONG-OPEN TIME METHACRYLATE STRUCTURAL ADHESIVES

Hovan G; Carbutt P; Wang X; Rosselli F
ITW Plexus
(Elsevier Science Ltd.)

While application requirements and product design typically dictate assembly methods and the choice of fastening techniques, advances in methacrylate structural adhesives continue to influence the assembly and performance of large parts such as composite bridges, windmill blades and large transportation vehicles. New, long open-time, structural methacrylate adhesives have been developed for assembling such large parts. Comparisons to typical assembly methods such as putties, mechanical fasteners and fibreglass tabbing are presented. Case examples of large part assembly utilising methacrylate adhesives are provided. 5 refs.

USA

Accession no.879307

Item 20

RP Asia 2002: Composites in the global market. Proceedings of a conference held Kuala Lumpur, Malaysia, 5th-6th Sept.2002. Oxford, Elsevier Science Ltd., 2002, Paper 8, p.167-74, 29cm, 012

USE OF ARALDITE ADHESIVES TO BOND COMPOSITE MATERIALS

Bieniak D
Vantico Pty.Ltd.
(Elsevier Science Ltd.)

The Adhesives and Tooling Division of Vantico Pty. Limited is an innovative developer and manufacturer of high quality Araldite, Epibond and Epocast epoxy resins systems, many of which are specifically used as adhesives, and also the Uralane PU adhesive systems. These adhesives can be used to bond a wide variety of substrates including composite materials which are being used widely in a variety of applications, some of which are discussed in this paper.

AUSTRALIA

Accession no.879306

Item 21

Revista de Plasticos Modernos
83, No.548, Feb.2002, p.138/41

Spanish
JOINING PLASTICS AND COMPOSITE MATERIALS

Sauer J
Vantico AG

The advantages of adhesive bonding over mechanical fastening in joining composite parts are discussed, and a number of examples are presented of composite structures bonded using structural adhesives.

SWITZERLAND; WESTERN EUROPE

Accession no.878010

Item 22

Journal of Adhesion
78, No.12, Dec.2002, p.1027-38

USE OF DIELECTRIC SPECTROSCOPY TO ASSESS ADHESIVELY BONDED COMPOSITE STRUCTURES. III. INVESTIGATION OF MECHANICAL STRENGTH

Banks W M; Boinard P; Pethrick R A
Strathclyde,University

The way in which the data obtained in part II (ibid, p.1015-26) from a dielectric study of CFRP bonded with an epoxy resin adhesive was related to the mechanical strength of the bonded structure was investigated. Exposure of the adhesively bonded joints to a hot and wet environment was shown to lead to a loss of strength. Changes were observed in the dielectric properties on exposure to the humid environment and an attempt was made to relate these observations to the mechanisms leading to loss in the mechanical strength of the bond. The observation of a correlation between the changes in these physical properties indicated the possibility of using dielectric spectroscopy as a powerful non-destructive evaluation technique for bonded composite structures. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.877949

Item 23

Journal of Adhesion
78, No.12, Dec.2002, p.1015-26

USE OF DIELECTRIC SPECTROSCOPY TO ASSESS ADHESIVELY BONDED COMPOSITE STRUCTURES. II. DIELECTRIC STUDY

Pethrick R A; Boinard P; Banks W M
Strathclyde,University

The sorption and desorption of moisture in a structural adhesive(epoxy resin)-bonded composite structure(CFRP) were studied using low- and high-frequency dielectric spectroscopy, with the adhesive subjected to a hot and wet environment. As water penetrated the structure, variations in the dielectric

permittivity and dielectric loss could be used to examine the nature of the absorption process. A dielectric tool was introduced to aid in interpretation of the dielectric data based on the Kirkwood-Frohlich equation of the dipolar activity. The data were correlated with gravimetric and DMTA of the adhesive during exposure to moisture reported in part I (ibid, p.1001-14). 30 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.877948

Item 24

Journal of Adhesion

78, No.12, Dec.2002, p.1001-14

USE OF DIELECTRIC SPECTROSCOPY TO ASSESS ADHESIVELY BONDED COMPOSITE STRUCTURES. I. WATER PERMEATION IN EPOXY ADHESIVE

Boinard P; Banks W M; Pethrick R A

Strathclyde, University

The effect of water ingress into the epoxy adhesive resin used in the manufacture of adhesive bonds in epoxy/graphite composite structures was studied. DMTA and gravimetric analysis were conducted of the effects of water uptake and the data were interpreted in terms of various processes that could occur within the adhesive. Unexpectedly high values of water absorption were observed in samples where the edges were unconstrained and presented direct access to the fibre matrix for the moisture. The results demonstrated the effects of post-cure and leaching on the sorption and desorption processes. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.877947

Item 25

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 13; Chemistry and Rheology, Paper 3, p.353-6, 29cm, 012

QUALITY CONTROL WITH NEUTRON RADIOGRAPHY OF ADHESIVELY BONDED JOINTS

Kosteas D; Michaloudaki M

Munchen, Technische Universitat (Institute of Materials)

The results are reported of a study of the reliability of neutron radiography for detecting defects in adhesively bonded lap joint composed of steel adherends bonded with an epoxy adhesive. Tomographies from six lap joints showing an ideal bond and bonds with imperfections, such as oil drops, Teflon layers and moisture, are presented and discussed. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.876624

Item 26

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 13; Chemistry and Rheology, Paper 2, p.349-52, 29cm, 012

DIELECTRIC NON-DESTRUCTIVE TESTING OF THICK FILM ADHESIVES

Comrie R; Affrossman S; Hayward D; Pethrick R A

Strathclyde, University (Institute of Materials)

The effects of exposure of thick film adhesively bonded lap shear joints to moisture was investigated using broad band dielectric non-destructive testing. The lap shear joints were produced from aluminium alloy bonded with a dicyandiamide cured carboxy-terminated butadiene-acrylonitrile toughened epoxy adhesive and were aged by exposure to a warm humid environment and cycled between 42 and 48C hourly for two years. The data obtained were complemented by mechanical testing and failure analysis of the bond structure as a function of exposure time and a comparison was made of the ageing behaviour of thick and thin film adhesive systems.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.876623

Item 27

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 9; Chemistry and Rheology, Paper 4, p.287-90, 29cm, 012

ENHANCEMENT OF ALUMINIUM ADHESIVE BONDS BY BTSE PRE-TREATMENT

Tilset B G; Bjorgum A; Lapique F; Simensen C J

SINTEF Materials Technology (Institute of Materials)

The effectiveness of bis(triethoxysilyl)ethane (BTSE) and gamma-aminopropyltriethoxysilane (APS) either alone or in combination as pretreatments for the adhesive bonding of aluminium alloy with epoxy resin adhesives was investigated using wedge tests and acidified salt spray tests. It was found that BTSE pretreatment increased the durability of the adhesive bonds by decreasing the hydrolysis and/or corrosion rate at the metal-adhesive interface whereas APS increased the original strength of the bond by chemical interaction with the epoxy adhesive and increased the corrosion/hydrolysis rate, resulting in bond failure. 1 ref.

EUROPEAN COMMUNITY; EUROPEAN UNION; NORWAY; SCANDINAVIA; UK; WESTERN EUROPE

Accession no.876609

Item 28

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 9; Chemistry and Rheology, Paper 2, p.279-82, 29cm, 012

**THE DURABILITY OF ADHESIVE JOINTS:
EFFECT OF A SILANE PRETREATMENT**

Korenberg C F; Kinloch A J
London, Imperial College of Science, Technol. & Med.
(Institute of Materials)

The durability of tapered steel and aluminium alloy double-cantilever beam joints bonded with a dicyandiamide cured diglycidyl ether of Bisphenol A toughened with a liquid rubber was investigated at 21C and 55% RH and in water at different rates of displacement. The substrates were pretreated with a solution of gamma-glycidoxypropyltrimethoxysilane and the effect of this pretreatment on the durability of the joints was determined and compared to grit blasting and degreasing. The fracture energy of the joints was determined and plotted against crack velocity and the data compared with theoretical predictions. It was found that silane pretreatment increased fracture energy in two regions as a result of covalent bond formation at the interface. 19 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876607

Item 29

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 9; Chemistry and Rheology, Paper 1, p.275-8, 29cm, 012
WARM WATER AND SILANE TREATMENTS OF ALUMINUM FOR STRUCTURAL ADHESIVE BONDING

Underhill P R; Rider A N; DuQuesnay D L
Australia, Dept. of Defence; Canada, Royal Military College
(Institute of Materials)

The results are reported of a study of the effect of the treatment of bare aluminium alloy with deionised water at temperatures of 40C and 50C on the performance of adhesive joints in the wedge test. The fracture energies of samples treated at both 40C and 50C after 6 days of exposure are compared. The findings are considered comparable to those obtained with boiling water. 7 refs.

AUSTRALIA; CANADA; EUROPEAN COMMUNITY;
EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.876606

Item 30

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 8; Chemistry and Rheology, Paper 3, p.269-72, 29cm, 012
ORGANOSILANE TREATMENTS FOR ALUMINIUM ALLOYS

Allington R D; Davis S R; Digby R P; Porritt N; Shaw S J
QinetiQ; Airbus UK
(Institute of Materials)

The results are briefly reported of Boeing wedge tests carried out on joints of silane-treated aluminium alloy and epoxy resin adhesive to determine the effects of several experimental parameters on the durability of the adhesive joints. Variables investigated were solvent type, silane concentration, pH, hydrolysis time prior to application and silane film drying conditions. Failure mechanisms are also briefly considered. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876605

Item 31

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 8; Chemistry and Rheology, Paper 2, p.265-8, 29cm, 012
THE ROLE OF SURFACE ANALYSIS IN UNDERSTANDING THE INTERFACIAL CHEMISTRY OF ORGANOSILANE TREATMENT FOR ADHESIVELY-BONDED METAL STRUCTURES

Abel M-L; Rattana A; Watts J F
Surrey, University
(Institute of Materials)

The results are reported of an investigation into the interfacial chemistry at epoxy resin/glycidoxypropyltrimethoxysilane(GPS)/aluminium interfaces carried out using X-ray photoelectron spectroscopy and time-of-flight secondary ion mass spectrometry. Data from experiments on the interaction between an analogue of an amine-cured epoxy resin and untreated or treated GPS, adsorption of an uncrosslinked epoxy resin on oxidised aluminium treated with GPS and the interaction between a commercial dry film epoxy adhesive and untreated and GPS-treated aluminium are presented and discussed. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876604

Item 32

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 31, p.226-9, 29cm, 012
AN EVALUATION OF CHROMATE-FREE ANODISING PROCESSES FOR AEROSPACE APPLICATIONS

Yendall K A; Critchlow G W; Andrews F R; Bahrani D
Loughborough, University; Short Brothers; Bombardier Aerospace
(Institute of Materials)

The feasibility of using boric sulphuric acid anodising as a replacement for chromic acid anodising in the pretreatment of aerospace-grade aluminium alloys was

investigated. Single lap shear, wedge, fatigue and T-peel tests were carried out on aged and unaged pretreated aluminium joints bonded with BR 127/FM 73 adhesive. The joint strengths obtained using both treatments were compared and the performance of the joints in wedge tests after treatment with an electrolytic phosphoric acid deoxidiser or post-treatment dipping in phosphoric acid assessed.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876595

Item 33

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 23, p.198-201, 29cm, 012 **FATIGUE LIFETIME PREDICTION IN COMPOSITE BONDED JOINTS**

Abdel Wahab M M; Ashcroft I A; Crocombe A D
Surrey,University; Loughborough,University
(Institute of Materials)

The development of a numerical approach for predicting fatigue crack growth in adhesively bonded joints using finite element analysis is described. Double cantilever beam joints were used to generate a fatigue crack growth law, which was then implemented within a finite element subroutine to predict the load-number of cycles to failure for single lap and double lap joints. These predictions were then compared with experimental findings to verify the validity of the approach. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876587

Item 34

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 22, p.194-7, 29cm, 012 **AN EXAMINATION OF THE CORRELATION BETWEEN WEDGE TEST PERFORMANCE AND THE FATIGUE LIFE IN SHEAR OF ALUMINUM JOINTS**

Underhill P R; McBride S; DuQuesnay D L
Canada,Royal Military College
(Institute of Materials)

Aluminium joints were subjected to various surface treatments, including grit blasting, silane treatment, boiling water treatment and phosphoric acid anodisation and the performance of the joints in wedge testing investigated. The fatigue life of the joints subjected to a shear stress of 20 MPa under dry and wet conditions was determined as a function of the fracture energy obtained from the wedge test after 6 days of exposure. A relationship was established between the fracture energy

and the wet fatigue life of the joints, which could be approximated by a power law. 6 refs.

CANADA; EUROPEAN COMMUNITY; EUROPEAN UNION;
UK; WESTERN EUROPE

Accession no.876586

Item 35

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 20, p.185-9, 29cm, 012 **VARIABLE AMPLITUDE FATIGUE OF BONDED DCB JOINTS**

Erpolat S; Ashcroft I A; Crocombe A D
Loughborough,University; Surrey,University
(Institute of Materials)

Double cantilever beam joints composed of CFRP panels bonded with an epoxy paste adhesive were subjected to variable amplitude fatigue testing. Fatigue crack propagation curves were obtained by calculating the strain energy release rate using experimental compliance measurements, a beam-on-elastic/plastic foundation model, beam-on-elastic foundation model and cantilever beam theory and the experimental findings compared with the theoretical predictions. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876584

Item 36

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 17, p.172-5, 29cm, 012 **LONG-TERM DURABILITY OF ADHESIVELY BONDED LAP SHEAR JOINT OF AUSTENITIC STAINLESS STEEL**

Hakala K; Tiainen T
Tampere,University of Technology
(Institute of Materials)

Single lap joint austenitic stainless steel specimens bonded with either epoxy or PU adhesives were exposed to static load under conditions of constant temperature and humidity and the residual strength of the adhesive joints was determined as a function of exposure time. Using the data obtained, a mathematical model was developed to predict joint durability and shown to be capable of predicting the residual strength of the adhesives after exposure for a year to environmental conditions in Finland. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND;
SCANDINAVIA; UK; WESTERN EUROPE

Accession no.876581

Item 37

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 7; Chemistry and Rheology, Paper 13, p.157-60, 29cm, 012
DIELECTRIC NON DESTRUCTIVE TESTING OF CARBON FIBRE ADHESIVE COMPOSITE STRUCTURES

Banks W M; Boinard P; Pethrick R A
Strathclyde, University
(Institute of Materials)

Moisture absorption in adhesive joints consisting of carbon fibre-reinforced plastic adherends bonded with a polymeric woven fibre supported epoxy resin were investigated using dielectric spectroscopy. The mechanical properties of the joints subjected to a tensile force were also investigated and fracture surfaces of the joints analysed after exposure to hot/wet environments. The residual mechanical strength of the joints as a function of water content was correlated with the dielectric properties and a method to aid in the understanding of changes in dipolar activity, termed the Ng factor, upon moisture absorption developed.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876577

Item 38

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 6; Chemistry and Rheology, Paper 2, p.100-1, 29cm, 012
MECHANICAL PROPERTIES OF STRUCTURAL ADHESIVES USED IN ROCKET MOTORS

Kavanagh G M; Tod D A
QinetiQ
(Institute of Materials)

The results are reported of a brief investigation of the mechanical properties of a rocket motor adhesive carried out using DMA over a temperature range from -110 to +200C. The adhesive employed was a dicyandiamide cured diglycidyl ether of Bisphenol A toughened with a liquid rubber and shear modulus, loss modulus and tan delta were recorded as a function of temperature.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876563

Item 39

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 5; Chemistry and Rheology, Paper 4, p.91-4, 29cm, 012
BONDING OF STAINLESS STEEL IN THE BODY SHOP

Brockmann W; Neeb T

Kaiserslautern, University
(Institute of Materials)

The results are reported of a study of the properties of stainless steel joints bonded with a crash-toughened epoxy adhesive (Dow BM 1493) or a two-component acrylic adhesive (Agomer F347 HI). Tests were carried out to determine the stress-strain properties of the adhesives and the lap shear strength of the joints in the initial state and after ageing in lubricant. Surface topographies were analysed using a UBM Microfocus with a tip diameter of 2 micrometers and the surface roughness of etched, blasted and rolled surfaces illustrated. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
UK; WESTERN EUROPE

Accession no.876561

Item 40

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 3; Chemistry and Rheology, Paper 3, p.39-42, 29cm, 012
THE BEHAVIOUR OF ADHESIVELY BONDED-BEAMS VERSUS THEIR WELDED EQUIVALENT

Hashim S A; Loke K L
Glasgow, University
(Institute of Materials)

The behaviour of thick adhesively bonded and welded beams fabricated from mild steel and subjected to three-point bend tests under simply supported boundary conditions was investigated and compared. The beams, which included rectangular section, T, L and Z stiffeners with various spans, were bonded with a single-part epoxy adhesive and analysed using sandwich beam theory and finite element analysis. Measurements were made of the maximum stresses and deflections under quasi-static loading and interface coefficients for stresses and deflections used in conjunction with solid beam theory to determine the levels of stresses and deflections in the beams. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.876551

Item 41

EURADH 2002. Adhesion '02. Proceedings of a conference held Glasgow, 10th-13th Sept.2002. London. IOM Communications Ltd., 2002, Session 2; Chemistry and Rheology, Paper 3, p.24-7, 29cm, 012
THE APPLICATION OF THE SCANNING KELVIN PROBE FOR INVESTIGATING THE DEADHESION OF ADHESIVES ON IRON AND ZINC
Wapner K; Stratmann M; Grundmeier G
Max-Planck-Institut fuer Eisenforschung
(Institute of Materials)

The application of the scanning Kelvin probe to the measurement of electrochemical potentials of polymer/

metal systems at buried interfaces and of the delamination of an epoxy resin with a 4-aminosalicylic acid primer and a defect filled with sodium chloride, as electrolyte, from an iron surface is demonstrated. Small spot X-ray photoelectron spectroscopy is employed to verify the mechanism of delamination (cathodic) and a schematic of the delamination model including reactions and ion migration is included. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.876547

Item 42

Rubber and Plastics News

32, No.12, 13th Jan.2003, p.10

QUICK-DRY EXPERTS

Boyd J

Depending on temperature, humidity and the type of adhesive used, the time it takes for a windshield adhesive to cure adequately to meet Federal Motor Vehicle Safety Standards can range widely, from 30 minutes to 72 hours. That is the dilemma facing Sika Corp.'s Sika-Industry division, the world's largest manufacturer of PU adhesives for auto glass replacement. Sika-Industry has spent more than 1m US dollars testing and validating the cure time of its PU auto glass adhesives, developing its Sika Safe Drive Away Time charts. Sika's fastest-curing products are hot-applied adhesives, in which the adhesive is heated in the dispenser, making it a uniform temperature and viscosity for application regardless of outside temperatures. Sika's hot applied Ultrafast II product, for example, will cure to a safe strength in 30 minutes on a car without a passenger side air bag as long as humidity is above 20% and the temperature is between 16F and 95F.

SIKA CORP.
USA

Accession no.876417

Item 43

European Medical Device Manufacturer

13, No.7, Nov.-Dec.2002, p.70

LIGHT-CURE CYANOACRYLATES OPTIMIZE DEVICE ASSEMBLY

Sparrow N

The topic under the microscope in this detailed article is the use of light-curing cyanoacrylate adhesives (UVCAs) for medical device assemblies. These adhesives are blessed with rapid cure rates and shadow curing capabilities, which are attractive properties for manufacturers making their adhesive selection.

LOCTITE CORP.
USA

Accession no.875114

Item 44

Adhesion Kleben & Dichten

46, No.9, 2002, p.36-7

German

ADHESIVE TECHNIQUE ENABLES PRODUCTION OF MICRO-FUEL CELLS

Maurieschat U; Bilsing A; Born E
IFAM

The great importance of fuel cells in the current debate about environmentally compatible power generation arises out of their achievable high level of electrical effectiveness, while energy resources receive careful treatment at the same time and substances harmful to humans are reduced. As a response to the challenge of miniaturising fuel cells yet further, the Fraunhofer Institut fuer Fertigungstechnik und Angewandte Materialforschung, Klebtechnik und Oberflaechen (IFAM) and the Fraunhofer Center for Manufacturing Innovation (CMI) in Boston, USA, have succeeded in integrating an adhesive technique and a suitable range of tasks into a relevant assembly cell for manufacturing fuel cells as shown in this article.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.874840

Item 45

Adhesion Kleben & Dichten

46, No.9, 2002, p.16/20

German

PUR HOTMELTS IN THE MANUFACTURE OF SANDWICH ELEMENTS

Starck F; Terfloeth C

Panelling, flooring and ceiling elements in commercial vehicles are mainly produced with a sandwich structure. Two-component polyurethane adhesives are usually used in this process and treated cold. However, with this method, a processing time of several hours is required after jointing together. Examples given in this article show how using reactive hot melt adhesives can optimise productivity in the manufacture of composite elements. 5 refs.

JOWAT LOBERS & FRANK GMBH & CO.KG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.874837

Item 46

Adhesion Kleben & Dichten

46, No.7-8, 2002, p.36-41

German

HOW LONG DO PRETREATED ALUMINUM GLUED JOINTS HOLD FOR? (PART II)

Brockmann W; Emrich S
Kaiserslautern, University

Building on results given in the May 2002 issue of this journal, this article discusses tasks that supply clues to the long-term stability of glued aluminum joints by applying static charges. It describes transverse strain sliding behavior in glued joints by relying on surface pretreatment. It also introduces criteria for active mechanisms in surface pretreatment methods that can be important for getting polymers to adhere to aluminum in a manner that lasts a long time and is stable. 11 refs.

IFAM

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.874836

Item 47

Adhasion Kleben & Dichten

46, No.7-8, 2002, p.24/8

German

**HIGH-TENSILE STRENGTH, CRASH-
RESISTANT AND SUITABLE FOR
PRODUCTION RUNS**

Symietz D

Dow Automotive AG

For some years the most modern 1K adhesives systems have been available, which show high-quality, partly superior alternatives to classical jointing methods like point-welding in the vehicle industry. As a decisive factor for such areas of application, their combination of great toughness and stability under load impact has been achieved through using a new principle of viscosity. Experience is now available for mass production and is very promising regarding hybrid jointing. Examined here are issues of benchmarking in jointing procedures in the car industry along with how adhesives contribute to the implementation of bodywork designs and multi-functional potential in structural gluing.

SWITZERLAND; WESTERN EUROPE

Accession no.874833

Item 48

Adhasion Kleben & Dichten

46, No.7-8, 2002, p.12/7

German

**ADHESIVES SOLUTIONS IN BUS
CONSTRUCTION WITH A SYSTEM**

Burchardt B; Wappmann R

Sika Schweiz AG

Use of glues in bus construction has reached a high level. Applications listed in this article explain why this is so. They also look at how reliable you can regard the durability of glued joints in bus construction. Examples taken from this area of work for jointing solutions offer an impression of the possible uses for this method of bonding along with a list of impressive advantages. Practical applications include a calculation for an adhesive

layer for a bus front windscreen and tension distribution on a model.

SWITZERLAND; WESTERN EUROPE

Accession no.874832

Item 49

EAS:European Adhesives Sealants

19, No.5, Dec.2002, p.12-3

CASTING A BEADY EYE ON CARS

Yorkgitis E; Robinson L

3M Center

Automotive manufacturers are dramatically increasing their use of two-part structural adhesives, especially in body closure bonding. However, a 2K adhesive introduces more complicated dispensing equipment and the need to control specific mix ratios. Ford has developed a patented system that enables adhesive mixing to be monitored in real time as it is dispensed. The new system "tags" one component of a 2K adhesive with microscopic strainless steel-coated glass bubbles that are detected by two eddy current sensors integrated into the dispensing equipment. The technique enables full control of the dispense ratio for the first time. The proprietary taggant can tag virtually any 2K adhesive with no change in its appearance or performance. An example of this is the use of a tagged high-performance epoxy currently being used to bond aluminium hood assemblies for the Ford Ranger pickup truck.

USA

Accession no.874709

Item 50

Adhesives Age

45, No.11, Nov.2002, p.9

EURO GLUE GROWTH

Bowtell M

A report published in June by IAL Consultants takes in both the West and East European markets for 2001 for all adhesives, which for West Europe was an estimated 3.1bn US dollars or around 15% of the world market. A significant use of adhesives is made by the automotive industry. IAL says research suggests that car repairers who use PU adhesives are at risk, because uncured PUs can release dangerous isocyanate emissions. There appears to be an increasing move away from the use of one- to two-component systems for auto OEM applications. One-component PU is the material of choice for OEM direct glazing, while for the repair market, two-component products are used due to their faster cure time. Modified silane polymers continue to penetrate most markets in Europe as an alternative to PUs and other sealants.

IAL CONSULTANTS LTD.

EUROPE-GENERAL

Accession no.874607

Item 51

Adhasion Kleben & Dichten

46, No.11, 2002, p.32-6

German

NMR MOUSE ENABLES ONLINE QUALITY CONTROL IN MOTOR VEHICLE CONSTRUCTION

Kremer K; Kuehn H; Bluemich B; Seitzer J; Schmitz F P
Aachen,RWTH; Eftec Europe Holding AG

The so-called NMR mouse entails a handy, simple, mobile measuring head that functions on the principle of nuclear spin tomography. It enables non-destructive measurements of objects of almost any shape up to around 10 mm depth. An interesting example of use is the online control for curing of polyurethane adhesives in a glass-metal composite used for car windscreens. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SWITZERLAND; WESTERN EUROPE

Accession no.874446

Item 52

Patent Number: US 6444355 B1 20020903

ADHESIVE FOR BATTERY, BATTERY USING THE SAME AND METHOD OF FABRICATING THE SAME

Murai M; Inuzuka T; Yoshida Y; Hamano K; Shiota H; Aihara S; Shiraga S
Mitsubishi Denki KK

A lithium ion battery comprises a positive electrode, a negative electrode and a separator for retaining an electrolyte. The positive electrode is bonded to the separator and the negative electrode is bonded to the separator with a thermosetting adhesive comprising a mixture of at least one organic vinyl compound containing two or more vinyl groups per molecule, a reaction catalyst and a volatile organic solvent.

JAPAN; USA

Accession no.870267

Item 53

International Journal of Adhesion & Adhesives

22, No.4, 2002, p.291-5

TESTING OF ADHESIVES FOR BONDING OF POLYMER COMPOSITES

Balkova R; Holcnerova S; Cech V
Brno,Technical University

Three epoxy resin-based adhesives were studied in order to select the most suitable for bonding glass fibre/polyester composites exposed to air at room temp. and 60C and to cool water. Lap shear specimens were tested at room temp. for one year. The most commonly-used adhesive, EPOXY 371, maintained the shear properties without great changes in all environments and exhibited the best shear strength in cool water. It was recommended for universal usage. Mixed adhesive-cohesive failure in the specimens with

increasing amount of cohesive failure for joints stored at room and elevated temp. was observed. Adherend was torn up at the joints with LETOXIT LX 012. Joints with this adhesive exhibited the best shear properties at room temp. and 60C, where damaged adherend area reached up to 80% of the whole bonded area. 3 refs.

CZECH REPUBLIC

Accession no.866020

Item 54

Adhesives Age

45, No.8, Aug.2002, p.9

LATEST IN ADHESIVE USES

Bowtell M

Papers concerning new adhesive technologies for construction and transportation were the main theme of the recent Swiss Bonding International Congress. Swiss Federal Laboratories for Materials Research presented a paper which dealt with the bonding of carbon fibre-reinforced plastic strips on concrete with stress gradients and process control. A paper presented by Crompton SA addressed silylated PU technology for transportation applications. Acrylic double performance technology that offers new possibilities for replacing mechanical fasteners and welding was the subject of a paper by Sika AG.

SWITZERLAND; WESTERN EUROPE

Accession no.865379

Item 55

Journal of Composites Technology & Research

24, No.3, July 2002, p.188-208

STRENGTH AND FATIGUE LIFE MODELLING OF BONDED JOINTS IN COMPOSITE STRUCTURE

Hoyt D M; Ward S H; Minguet P J

NSE Composites; SW Composites; Boeing Co.

The aerospace industry lacks a validated, practical analysis method for the strength, durability and damage tolerance evaluation of composite bonded joints. The results of a combined strength and fracture analysis approach applied to typical bonded joint configurations found in rotorcraft composite structures are presented. The analysis uses detailed 2D non-linear finite element models of the local bondline. Strength-of-materials failure criteria are used to predict critical damage initiation loads and locations. A fracture mechanics approach is used to predict damage growth and failure under static and cyclic loads based on test data for static fracture toughness (GIc, GIIc) and crack growth rate (da/dN). Results are presented from the application of the analysis approach to two joint configurations: a skin-stiffener T-joint and a bonded repair lap joint. The results show that the proposed approach can be used to predict critical failure modes, damage initiation loads and locations, crack and/or delamination stability, static strength, residual strength and fatigue life.

Discussion is also included on how this approach can be applied in damage tolerance evaluations of composite bonded joints. 20 refs.

USA

Accession no.863741

Item 56

Cambridge, 2002, pp.6, 29 cm, 16/7/02

ARALDITE 2000. GENERAL BONDING ADHESIVES

Vantico Ltd.

A properties and performance chart is presented for grades of Araldite 2000. The suitability of each grade for bonding a variety of substrates is indicated, together with resistance to chemicals, heat, water and impact, service temperatures, cure times, shelf life, and strength. Key questions to be considered when selecting an Araldite 2000 adhesive are included to highlight potential bonding solutions for some of the principal manufacturing fastening requirements. The grades are based on epoxy, methacrylate, and polyurethane.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.863277

Item 57

Adhasion Kleben & Dichten

46, No.6, 2002, p.30-1

German

TECHNICAL ADHESIVE PROCESSES SUMMARISED (PART IV) - CASTING AND INJECTION ADHESION

Elsner H

Dorel Verlags GmbH & Co.

This article is part of a number of contributions looking at which technical adhesive processes there are and what the principles are under which they function. Discussion has also covered which types of adhesive are being used at any time and what technical production details a manufacturer must take note of in order to attain adhesion that is stable over a long period. In a series of short explanations, adhesives and their chemical properties have not been the focal point, but the technical production implementation of industrial adhesion technology has. Here this article deals with casting and injection adhesion, including technical application features, casting of electronics components, underfill of chips/integrated circuits, surface casting and injection adhesion of framework nodes.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.862766

Item 58

Adhasion Kleben & Dichten

46, No.6, 2002, p.27-9

German

PRIMED METAL SURFACES FLEXIBLY GLUED TOGETHER WITH PU AND MS SYSTEMS

Preusser W; Gierl C

Vienna, Institut fuer Klebetechnik

Although today modern adhesive techniques have reached a considerable level of development, the effect from different surface conditions on the quality of gluing items together is still not comprehensively explained. Knowledge about interaction between adhesive and defined surfaces is not only of great importance for the development of improved systems, but also plays an important role from economic considerations. This article includes discussion on substrates like aluminium and steel and the effects of stress, temperature changes and aqueous primary coats. 2 refs.

AUSTRIA; EUROPEAN UNION; WESTERN EUROPE

Accession no.862765

Item 59

Adhasion Kleben & Dichten

46, No.6, 2002, p.18-9

German

MODERN ADHESIVE SYSTEMS FOR MANUFACTURING ELECTRONICS ITEMS

Tetzner G

Panacol Elosol GmbH

This article looks at how electronics adhesives protect circuits or components from harsh environmental conditions, how they make a contribution to reductions in component overall size and how they prolong product lifespan. Comment is given on how glob top materials protect electronic circuits on printed circuit boards from damaging environmental effects. The 'frame and fill' technique is discussed as an alternative to the often required, but costly metal frame. Also covered is chip bonding that facilitates economic production.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.862762

Item 60

Patent Number: EP 1229555 A1 20020807

SHIELDED FLAT CABLE

Sakurai R; Hiraoka H; Okada T; Morimura Y; Miura T
Bridgestone KK

By using a conductive adhesive prepared by dispersing conductive particles, such as a nickel filler, in a thermally or optically curable adhesive comprising a heat resistant, flexible base resin, such as EVA, PVB, acrylic resin or unsaturated polyester, as an adhesive for making the shielding conductive layer of a shielded flat cable conductive with the

ground line of a cable body in a non-insulated portion and bonding the cable body to the shielding member, the heat resistance and connection reliability in a high temperature and high humidity condition of the shielded flat cable are ensured. To further improve adhesion, a phosphoric acid methacrylate and melamine-based resin are blended with the above base resin.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN;
WESTERN EUROPE-GENERAL

Accession no.862262

Item 61

Journal of Adhesion Science and Technology

16, No.11, 2002, p.1407-29

THE EFFECT OF MOISTURE ON THE FAILURE LOCUS AND FRACTURE ENERGY OF AN EPOXY-STEEL INTERFACE

Loh W K; Crocombe A D; Abdel Wahab M M; Watts J F; Ashcroft I A

Surrey,University; Loughborough,University

An epoxy-steel interface was exposed to various moisture uptake levels and tested using the mixed mode flexure test. Both bulk adhesive and open-faced samples were exposed to the moisture and fracture parameters were obtained as a function of moisture level using finite element analysis. The nature of the failure surfaces and the relationship between the degradation in fracture energy and changes in failure locus were examined by means of techniques, such as X-ray photoelectron spectroscopy and scanning electron microscopy. The locus of failure was found to be very close to the steel and to progress towards the steel surface as moisture content increased. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.862211

Item 62

Shawbury, Rapra Technology Ltd., 2002, pp.132, 30 cm, 1/6/02. Rapra Review Report 143, Vol. 12, No.11, 2002. NALOAN

ADHESION AND BONDING TO POLYOLEFINS

Brewis D M; Mathieson I

Loughborough,University

Edited by: Ward S

(Rapra Technology Ltd.)

Rapra Review Report No. 143

This review of adhesion and bonding to polyolefin covers theories of adhesion, including factors affecting wettability and diffusion. Methods used to study surfaces are discussed, and include X-ray photoelectron spectroscopy, static secondary ion mass spectrometry and reflection IR. The pretreatment and use of primers for bonding polyolefins is examined, with reference to both plastics and elastomers. 422 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.858074

Item 63

(Eastleigh), 2002, pp.4, 29 cm, 11/6/02

PRODUCT SELECTOR GUIDE. PERMABOND ADHESIVES FOR THE MEDICAL DEVICE INDUSTRY

Permabond Ltd.

A typical properties and adhesion guide is presented for grades of Permabond adhesives for use in the medical device industry. Grades available include cyanoacrylates, light curing acrylates, and epoxies. For each, details are given of uncured and cured properties, curing, sterilisability, biocompatibility, and adhesion to a range of substrates.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.858058

Item 64

Adhasion Kleben & Dichten

46, No.5, 2002, p.34-9

German

HOW LONG DO PRE-TREATED ALUMINIUM ADHESIVES HOLD? (PART I)

Brockmann W; Emrich S

Kaiserslautern,University

This article asks the question whether the use of single standard ageing tests is enough in every case to assess the long-term consistency and reliability of aluminium epoxy resin adhesives subjected to different types of pre-treatment. Extensive tests have been conducted to answer this question. By using the car industry as a practical example, focus has been placed on the selection of adhesive and substrate as well as on ageing simulations. Part II of this article describes the results. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.857824

Item 65

Adhasion Kleben & Dichten

46, No.5, 2002, p.20/4

German

COPOLYESTER HOT MELT TYPE ADHESIVES IN THE CAR

Kemper P

Ems-Griltech

Because of their multifarious properties, profile copolyesters are gaining ever more importance even in the car industry. Hotmelts formulated with them are used for gluing filters together as well as for fabric decor materials. This article describes the advantages of their use and gives examples of applications and uses in order to provide an impression of their technical possibilities.

SWITZERLAND; WESTERN EUROPE

Accession no.857822

Item 66

Machine Design

74, No.10, 23rd May 2002, p.90-4

ATTACHMENT ANXIETY

Sakerni C; McGrath S

Loctite Corp.

Although advances in appliance technology are bringing new roles for adhesives, traditional uses still abound. For example, adhesives find widespread use in appliance-manufacturing applications for structural bonding, cylindrical assembly, thread-locking, flange and thread sealing, thermal management, wire bonding and harnessing, gasketing and sealing. Adhesives can bond dissimilar materials, reduce component inventory, and decrease total manufacturing costs, making possible many appliance designs that would be impossible or cost-prohibitive using mechanical-fastening methods. New uses are coming about because appliances are incorporating more high-performance power components, such as motors and more electronics. Also, pressures to cut production time are encouraging manufacturers to deploy adhesives more frequently. New washing machines use small, high-performance motors and pumps that run at high speeds, producing elevated temperatures and increasing vibrational shock. While traditional thread-lockers can withstand some level of vibration, the combination of heat and continuous vibration requires using toughened anaerobic thread-lockers that retain commutators and bearings to the motor shaft, secure bolts and screws, and seal the metal gear pin to the transmission housing. These toughened thread-lockers resist shock and vibration by maintaining a certain level of flexibility. A review of the technology is presented.

USA

Accession no.857511

Item 67

Adhesives & Sealants Industry

9, No.4, May 2002, p.49-50

**AUTO ADHESIVE EXTRUSION SYSTEMS
ACHIEVE HIGHER QUALITY WITH SENSOR
SYSTEM**

Trees B

Precitec Inc.

The features and benefits of an adhesive sensor system from Precitec Inc. are briefly described. This system is capable of controlling the standoff distance from a glue nozzle to a workpiece during extrusion and is currently being used on robotic and pedestral adhesive stations at various automotive plants in the USA. The components of the sensor are illustrated.

USA

Accession no.856750

Item 68

Journal of Adhesion Science and Technology

16, No.4, 2002, p.373-93

**MOISTURE DURABILITY OF FOUR MOISTURE
CURE URETHANE ADHESIVES**

Verhoff J; Ramani K; Blank N; Rosenberg S

Purdue University; Sika Corp.

The moisture durability of four low modulus adhesives was examined, the adhesives all containing the same basic moisture cure polymers (SikaFlex PUs) but different fillers (chalk, clay/PVC and clay/carbon black) and additives. Hot-dipped galvanised steel was bonded to random fibre-reinforced unsaturated polyester and aged in two moisture environments for various durations. Diffusion coefficients, moisture uptake and modulus changes due to moisture environment were determined for the adhesives and the fibre-reinforced plastic. The moisture cure adhesives with clay/PVC as filler had the highest retained lap joint strengths. 16 refs.

USA

Accession no.854733

Item 69

Materials for Lean Weight Vehicles IV. Proceedings of a conference held Gaydon, UK, 30th.-31st. Oct. 2001.

London, Institute of Materials, 2001, Paper 8, pp.8, 012

**BONDED VEHICLE BODY DURABILITY
TESTING - ASTON MARTIN VANQUISH**

Kapp J; Sanders R

Ford Motor Co.Ltd.

(Institute of Materials)

The Aston Martin Vanquish uses hybrid material combinations of aluminium alloys, polymers and composites, and as such conventional joining technologies such as welding and extensive mechanical fasteners is not viable. Therefore, this vehicle makes extensive use of adhesives to join principle structural parts. Adhesives are used which have not previously been used in such significant applications within the motor industry, and so a full vehicle structural durability trial was undertaken using a 4-poster road simulator rig with environmental conditioning. The test programme included simulated road loading and cyclic temperature and humidity profiles, results of which confirmed the mechanical durability of adhesive bonding technology designed into the vehicle. In addition, the test method described, demonstrated good correlation with more conventional testing of adhesive joints, permitting confident use of the technique for future performance verification requirements.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.853963

Item 70

Chemical Week

164, No.15, 10th April 2002, p.24-5

JOLTED ELECTRONICS MARKET EXPECTS A SLOW RECOVERY

Kemezis P

The electronic adhesives and encapsulants sector, like the rest of the electronics materials market, has experienced a profound slump over the last 12 months and is only now beginning to see signs of recovery. Meanwhile, electronics adhesives are being required to improve their offerings to meet the sector's changing needs. Earlier this year, Dow Corning introduced a series of thermally conductive silicone-based adhesives for packaging applications aimed at providing better thermal dissipation and structural flexibility to relieve stress in finished packages. A key challenge is to develop products that work with lead-free solder which has a 260C reflow temperature compared to 220C for traditional lead solder. Loctite has introduced a new underfill epoxy product that has a reworkability feature. It allows the manufacturer to place chips on a board and test them. A defective chip can be removed by reheating the board and replaced without affecting the integrity of the rest of the board.

WORLD

Accession no.852356

Item 71

Adhesives Age

45, No.3, March 2002, p.S12-4

BIG THINGS IN SMALL PACKAGES

Herold S

DELO Industrieklebstoffe

Developments in light-activated epoxy adhesives, such as Delo-Katiobond, which are particularly suitable for use in the electronic industry where the trend is towards the miniaturisation of modules, structural components and end products, are discussed. The benefits offered by these adhesives are outlined and some examples of the use of these adhesives in the electronic industry are presented. (FEICA, World Adhesives Conference, September 2000, Barcelona, Spain)

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.852310

Item 72

Adhasion Kleben & Dichten

46, No.3, 2002, p.30-3

German

MECHANICAL BEHAVIOUR OF ADHESIVE JOINTS DURING A CRASH

Gassan J; Harwick W

Faurecia SAI Automotive SAL; Fraunhofer-Institut fuer Kurzzeitdynamik

In many applications glued structures are subjected to complex physical stresses, e.g. in a vehicle crash. Although these have to be taken into account adequately during the design stage, up until now there has only been little knowledge about the behaviour of adhesive joints, for example, at speeds causing distortion when related to crashes. This article provides information about the effect of crash-related stretching rates on aluminium adhesive joints. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.850875

Item 73

Adhasion Kleben & Dichten

46, No.3, 2002, p.22-4

German

POLYOLEFINS STICK WITHOUT PRE-TREATMENT - POSSIBILITIES AND LIMITATIONS

Krueger G

This report looks at whether polyolefins like PE and PP can be glued reliably. It describes the results from tests performed with a methyl methacrylate adhesive. It also examines a simple application with DP 8005 twin cartridges, as well as tests on PP foils, presence of powdered glass in the adhesive and adhesive properties with steel and aluminium compound foils.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.850873

Item 74

Adhasion Kleben & Dichten

46, No.1-2, 2002, p.32-4

German

BEAD OF ADHESIVE ON THE TRACK

Mikeska H

VMT Bildverarbeitungssysteme GmbH

Whether we are talking about windscreens, replacement wheel troughs, assembly parts in the carcass or an electronic component, in ever more cases robots or CNC systems of coordinates help to fit large and small directly-attached parts on car bodywork parts like underbodies, doors, engine bonnets or cupboard units by applying different methods. Since the quality of these joints is decided in the end by the quality of the whole product, firms like the carmaker Opel AG are using the VMT ACS image-processing system to perform a continuous optical check on the application of adhesives. Difficult marginal conditions that vary greatly place high demands on the inspection system.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.850868

Item 75

International Journal of Adhesion & Adhesives

22, No.2, 2002, p.143-50

PRE-TREATMENT OF AA6060 ALUMINIUM ALLOY FOR ADHESIVE BONDING

Lunder O; Olsen B; Nisancioglu K

Sintef Materials Technology; Norwegian University of Science & Technology

AA6060 aluminium alloy extrusions were subjected to various surface treatments prior to bonding with an epoxy adhesive, exposure to chloride and ageing in an atmosphere of 82% relative humidity at 40 C for 50 d. The single lap joints were subjected to tensile testing. Alkaline etch pre-treatment resulted in a 7% reduction in strength, whilst desmutting with nitric acid after etching gave a greater loss in strength. A phosphate-permanganate conversion coating of the alkaline etched surface gave no improvement. The strength reductions were attributed to the presence of filiform corrosion filaments which enabled rapid moisture ingress. The best results were obtained by AC anodisation in hot sulphuric acid. 17 refs.

NORWAY; SCANDINAVIA; WESTERN EUROPE

Accession no.850813

Item 76

Reinforced Plastics

46, No.3, March 2002, p.46-8

BOATS BENEFIT FROM ADHESIVE BONDING

Prince K

The benefits of adhesives for use in boatbuilding are highlighted and recent developments in adhesives for bonding composites used in boats are discussed.

USA

Accession no.850421

Item 77

European Design Engineer

April 2002, p.67-8

OPTICALLY CLEAR ADHESIVES AND COATED FILMS FOR FLAT PANEL DISPLAY BONDING

Hopp M S

Adhesives Research Inc.

Compatible, functional bonding adhesives and adhesive coated films available for display devices are highlighted. Products considered include pressure-transfer adhesives, optically clear adhesives, strippable, optically clear transfer adhesives, optically clear films with optically clear adhesives for use as base films for filters, diffusers, transfectors holographic elements or backlight components in projection screens, touch screens and the like, and electronically clean adhesives for touch screens.

USA

Accession no.849951

Item 78

Weinheim, Wiley-VCH, 2000, pp.xi,372. 25cm. 63Tr

MATERIALS FOR TRANSPORTATION TECHNOLOGY: EUROMAT - VOLUME 1

Edited by: Winkler P-J

(DaimlerChrysler AG; Federation of European Materials Societies)

This book comprises part 1 of the proceedings of the EUROMAT 99 conference. 54 papers are presented on materials science relevant to road, air, rail and water transportation applications, of which many deal with metallic or ceramic materials. The use of pyrolysis gas chromatography-mass spectroscopy to determine the chemical effects of damage to polymeric materials is described. Techniques for the manufacture of natural-fibre reinforced thermoplastics for the automotive industry are described. The design, manufacture and testing of high-speed impellers made from carbon-fibre reinforced PEEK and polyamide is discussed. Techniques for damage detection in carbon fibre-reinforced plastics with piezoceramic inclusions are compared. The physical aging of polyimide adhesives used in bonding titanium components is studied. The use of elastomeric adhesives in road and rail vehicles and ships is briefly reviewed. The use of sandwich composites in military ship hulls and railway carriage bodies is described. The final relevant paper briefly reviews manufacturing techniques for carbon fibre-reinforced plastic materials.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; NETHERLANDS; SCANDINAVIA; SWEDEN; SWITZERLAND; UK; USA; WESTERN EUROPE

Accession no.849742

Item 79

Journal of Adhesion Science and Technology

16, No.1, 2002, p.15-32

LIQUID CRYSTALLINE VINYL ESTER RESINS FOR STRUCTURAL ADHESIVES

Ambrogi V; Carfagna C; Giamberini M; Amendola E; Douglas E P

Napoli,Universita Federico II; CNR; Florida,University

A liquid crystalline methacrylated monomer was prepared and tested for use as an adhesive. The synthesis was carried out by reacting methacrylic acid with a rigid-rod epoxy monomer derived from the reaction between p-(2,3-epoxypropoxy)-alpha-methylstilbene(DOMS) and aniline in a molar ratio of 3 to 2. The adhesion properties of the liquid crystalline resin prepared from this monomer were compared with those exhibited by a conventional (non-liquid crystalline) adhesive, the methacrylated derivative of an epoxy compound synthesised from a 3 to 2 molar ratio of Epon 825 epoxy resin and aniline. The adhesion of the two resins on a pretreated aluminium substrate was evaluated using mechanical tests and SEM. 46 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; USA; WESTERN EUROPE

Accession no.847473

Item 80

Adhesives & Sealants Industry

9, No.1, Feb. 2002, p.36

COMPOSITE WALL SYSTEMS ASSEMBLED WITH STRUCTURAL ADHESIVE

Araldite 2015 epoxy resin structural adhesive is supporting the fast assembly of durable glass-reinforced plastic sandwich construction wall systems at Norway's Marine Composites AS. The self-supporting walls are used in the manufacture of hygienic hospitals and buildings used by food processing, electronic and pharmaceutical industries. Araldite 2015 from Vantico was chosen for the project because of its ease of handling and performance characteristics, which include the ability to produce resilient bond lines that can withstand exposure to corrosive marine environments as well as extremes of temperature. Brief details are given of the project and the use of structural adhesives.

VANTICO INC.; MARINE COMPOSITES AS
NORWAY; SCANDINAVIA; USA; WESTERN EUROPE

Accession no.847414

Item 81

Macplas

26, No.227, April 2001, p.134-7

Italian

LIQUID CRYSTALLINE VINYL ESTER RESINS FOR STRUCTURAL ADHESIVES

Ambrogi V; Carfagna C; Giamberini M
Napoli,Universita; CNR

A liquid crystalline vinyl ester resin and an isotropic non-liquid crystalline vinyl ester resin of similar structure were evaluated as structural adhesives for aluminium substrates. The levels of adhesion were studied and related to the nature of the resins and the surface structure of the aluminium resulting from the formation of aluminium oxide and the application of adhesion promoting surface treatments. The liquid crystalline resin was found to give much higher adhesive energy than that achieved using its isotropic counterpart. 16 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE

Accession no.846237

Item 82

International Journal of Adhesion & Adhesives

21, No.6, 2001, p.495-502

TRANSFER OF STRESS THROUGH A STEEL TO CONCRETE ADHESIVE BOND

Barnes R A; Mays G C
Cranfield,University; UK,Royal Military College of Science

A series of fifteen experimental tests was conducted to investigate the transfer of stress through a steel-concrete adhesive bond obtained using a two-part structural epoxy resin adhesive. The experimental programme was

supported by theoretical and finite element analysis. The shear stress in a steel-concrete adhesive bond was found to be distributed exponentially, peaking at the loaded end of the specimen. For the specimens used, the stress distribution was distributed over a length of up to 155 mm for serviceability loads. 19 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.845877

Item 83

International Journal of Adhesion & Adhesives

21, No.6, 2001, p.487-93

PARAMETRIC STUDY OF FACTORS AFFECTING THE PULL-OUT STRENGTH OF STEEL RODS BONDED INTO PRECAST CONCRETE PANELS

Colak A
Istanbul,University

The effect of bond thickness, embedding length and type of epoxy resin adhesive formulation on the adhesion of steel anchors to concrete was studied. The test results indicated that the shear strength of the epoxy adhesive formulation prepared from DGEBA and an ethylene amine curing agent was independent of bond thickness from about 1 to 4 mm. The same was not, however, true for the DGEBA epoxy resin cured using an alkylene diamine curing agent, where markedly more complex behaviour was observed. The adhesive shear strength was shown to pass through a maximum value at 2 mm bond thickness. At thicknesses beyond 2 mm, the strength underwent a reduction until a value was reached which remained essentially constant with increased thickness. The variation in concrete strength was regarded as a main factor responsible for this complexity. The addition of filler to the adhesive formulation resulted in a reduction in the adhesive shear strength, the magnitude of the decline being largely dependent on the amount of filler used in the mixture. 6 refs.

TURKEY

Accession no.845876

Item 84

Watertown, Ma., c.2001, pp.6. 28cms. 4/1/2002

PRODUCT SELECTION GUIDE. EPOXY - URETHANE - SILICONE

Bacon Industries Inc.

A product selection guide is presented to the Bacon range of epoxies, urethanes and silicones for bonding, potting sealing, impregnating, and coating. Properties data are tabulated for the epoxy adhesive range, which includes fluid, flexible, thixotropic, and conductive grades. Typical cured properties are also listed for both epoxy and urethane adhesive ranges. Further tables of data are published for the company's epoxy potting and casting compounds, as well as for the epoxy and silicone series

of encapsulating compounds. The products are suitable for use in the electronics, instruments and medical industries.

USA

Accession no.843259

Item 85

Revue Generale des Caoutchoucs et Plastiques

78, No.796, June/July 2001, p.22-3

French

CAR WINDOWS: MOULDING THE NEUREDER WAY

Geller M

Neureder

An examination is made of the use of industrial robots and manipulators manufactured by Neureder in the application of primers and bonding agents to vehicle windows for the subsequent installation of injection moulded plastics seals.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.842587

Item 86

Industria della Gomma

45, No.3, April 2001, p.20-2

Italian

WATER-BASED BONDING SYSTEMS

Lindsay J

Mould Perfect Consultancy

Modifications to rubber-to-metal bonding processes made necessary by the use of water-based adhesives in place of solvent-based systems are examined. Procedures used in the control of such processes are also discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.842549

Item 87

Adhasion Kleben & Dichten

45, No.11, 2001, p.32-5

German

BONDING ALUMINIUM SHEETS SUCCESSFULLY COATED WITH DRY-FILM LUBRICANTS

Kleinert H; Gehrke J; Zschipke H

Dresden, Technische Universitat

This study addresses the issue whether a bond is possible on aluminium sheets that are coated with dry-film lubricants. This is shown to be possible with hot curing epoxy adhesives as they are used in car bodywork construction, only if the adhesive completely absorbs the coating as with metal sheets that have a lubricant covering. Materials used and test methods are discussed along with combined tension and shear resistance,

peeling behaviour of selected bonds and evaluation of fracture images. 2 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.842442

Item 88

Advanced Materials & Processes

159, No.12, Dec.2001, p.155-62

POLYMERS/CERAMICS/ADHESIVES

Tables are presented showing mechanical properties of selected engineering plastics, properties of common elastomers, properties of thermoplastics, typical properties of selected engineering ceramics, advantages and limitations of various types of adhesives, and typical properties of selected chemically reactive and hot-melt adhesives.

WORLD

Accession no.842323

Item 89

SAMPE Journal

37, No.6, Nov./Dec. 2001, p.7-13

STRUCTURAL BONDING APPLICATIONS FOR THE TRANSPORTATION INDUSTRY

Rosselli F; Carbutt P

ITW Plexus

The advantages and performance requirements of structural adhesives for bonding composites are briefly discussed and the technological benefits of using methyl methacrylates as structural adhesives in automotive and marine applications are demonstrated employing current end-use applications where methyl methacrylates have passed various crucial tests, including lap-shear, peel and cyclic fatigue testing. These applications are an automotive bumper and glass fibre-reinforced boat stringers. 6 refs.

USA

Accession no.839428

Item 90

Adhasion Kleben & Dichten

44, No.11, 2000, p.28-33

German

CATIONIC CURING ADHESIVES WITHOUT SHADOWING

Stumbeck M

Delo Industrieklebstoffe

Since the beginning of the 1990s, light-curing epoxy resins have seized a firm hold in the area of adhesives as well as coating and sealing compounds. In order to ensure safe curing even in shadowy zones, a new generation of cationic adhesives has now been brought onto the market. These adhesives, which can be cured with heat as well as light, have become renowned for low curing parameters

and high stability in storage at the same time. Examples are given for bonding electrical contacts, especially for moulding on chips, and for sealing safety relays.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.838545

Item 91

Adhasion Kleben & Dichten

44, No.6, 2000, p.18/23

German

MATERIAL TESTING OF ADHESIVES WITH REACTIVE HOTMELTS

Reinert U; Eisenbrand M

DEKRA AG; Kommerling GmbH

During lamination of PVC window sections, reactive polyurethane hotmelts are being applied increasingly. This is done for economic and ecological reasons. The quality of such an adhesive bond depends on the polyurethane's crosslinkage. Peel tests have been performed in order to examine the influence of storage time and storage temperature on the hotmelt's hardening reaction. For this purpose, it has been necessary to adapt the standardised peel test first of all to fit practical needs. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.838542

Item 92

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.283-6, 012

NOVEL NON-DESTRUCTIVE TECHNIQUE FOR THE EVALUATION OF ADHESIVELY BONDED STRUCTURES

Doyle G; Pethrick R A; Banks W M; Crane R L

Strathclyde,University; Wright-Patterson Air Force Base

(IOM Communications Ltd.)

High frequency dielectric measurements on aluminium adhesive bonded joints, exposed to a variety of solvents commonly in contact with aircraft structures, at a temp. of 65C, were conducted. The solvents used included hydraulic fluid, aviation fluid, propylene glycol and seawater. Solvent ingress was monitored in both the frequency and the time domain, allowing for changes in the dielectric permittivity and loss to be calculated. Frequency domain analysis allowed the effect of the ingress of solvents in the bondline to be assessed, whereas time domain analysis allowed for the identification of defects present in the bondline. In addition to the high frequency dielectric measurements, destructive mechanical shear and cleavage tests were carried out. The dielectric permittivity and loss were found to increase with ageing, whereas the mechanical strength of the joints was reduced. With completion of the ageing study, the

dielectric data obtained a new method for identifying the structural integrity of the adhesive bonded joints. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.838244

Item 93

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.275-8, 012

EXPERIMENTAL AND NUMERICAL STUDY OF AN ADHESIVELY BONDED JOINT FOR RAILWAY APPLICATIONS

Courgey A; Rousseau J; Gong X J; Landrot A G

Bourgogne,Universite; ALSTOM Transport (IOM Communications Ltd.)

The methodology used for designing an adhesively bonded joint between two thick composites adherends in a rail component application, i.e. a bogie chassis, is described. The experimental studies used glass fibre/epoxy resin composites and the adhesives were epoxide-based. The main difficulties in the design are shown to arise from the thickness of the adherends and the potentially wide range of service loads experienced by the bonded joint. Particular attention must be paid to the local behaviour of adherends, when bonding composite materials. Stress reductions near the joint edge are expected from local optimisation, such as modification of the adherend shape and the use of adhesive fillets.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; UK; WESTERN EUROPE

Accession no.838242

Item 94

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.265-8, 012

AN ASSESSMENT OF COLD-CURING ADHESIVES FOR USE IN A MARINE ENVIRONMENT

Bowditch M R; Hiscock D; Lane J M; Masters H J

DERA

(IOM Communications Ltd.)

Four cold-curing epoxide adhesive systems for bonding a PU and a polychloroprene rubber to carbon steel were evaluated in a search for materials suitable for use by the Royal Navy. It was found that two of the four adhesive systems examined were unaffected by exposure to seawater at 33C for six months. The general effect of cathodic protection was to exacerbate the effects of water immersion, although one adhesive system was surprisingly resistant. Heat ageing at 80C over a period of 14 days had no significant long-term detrimental effect on any of the materials investigated. All the primer/adhesive systems showed a marked and consistent loss of joint strength when debonded at the higher temp. of 80C.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.838240

Item 95

Structural Adhesives in Engineering VI. Conference
Proceedings.

Bristol, 4th-6th July 2001, p.257-60, 012

**MECHANICAL PROPERTIES OF ADHESIVELY
BONDED HUB/SHAFT JOINTS CURED UNDER
HYDROSTATIC PRESSURE**

Mengel R; Haeberle J; Schlimmer M

Kassel,Universitat

(IOM Communications Ltd.)

An adhesively-bonded hub/shaft joint was developed in which the adhesive was injected into a cavity of defined width between hub and shaft forming the adhesive layer. A special fixture allowed the adhesive to be subjected to hydrostatic pressure of up to 120 MPa when curing at room temp. After curing, the shear strength of the adhesive was determined by quasi-static tension of the joint as well as by torsion. Results were obtained for curing pressures varying from atmospheric pressure up to 120 MPa for various adhesives (methacrylate and epoxy based) and various combinations of adherent materials (steel shafts and aluminium alloy and magnesium alloy hubs). It was found that hydrostatic pressure on the adhesive during the curing process increased the TS as well as the torsional strength of the joint significantly compared with curing under atmospheric pressure.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
UK; WESTERN EUROPE

Accession no.838238

Item 96

Structural Adhesives in Engineering VI. Conference
Proceedings.

Bristol, 4th-6th July 2001, p.229-32, 012

**DURABILITY OF STRUCTURAL ADHESIVE
JOINTS**

Korenberg C F; Kinloch A J

London,Imperial College of Science, Technol.& Med.

(IOM Communications Ltd.)

The durability of rubber-toughened epoxy resin adhesive joints between identical substrates (aluminium alloy or steel) and different substrates (combinations of aluminium alloy and steel) was investigated under monotonic tensile loading, with and without the joints being immersed in water. The effects of cure and surface pretreatment on the durability of the joints were also studied. No difference was observed between the performances of similar and dissimilar substrate joints. Water was shown to have a detrimental effect on the toughness of the joints at low crack velocities. When the crack velocity was increased, a transition occurred above which water had no effect on fracture energy. Silane pretreatment was found to improve

the performance of the joints greatly under 'dry'
conditions and significantly under 'wet' conditions. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.838232

Item 97

Structural Adhesives in Engineering VI. Conference
Proceedings.

Bristol, 4th-6th July 2001, p.199-202, 012

**ROUGHNESS EFFECT ON CLEAVAGE
STRENGTH**

Shahid M; Hashim S A

Glasgow,University

(IOM Communications Ltd.)

Standard cleavage specimens were prepared using mild steel and a structural epoxy resin adhesive (Araldite 420A/B). The steel surfaces were subjected to diamond polishing or grit blasting. The effect of surface roughness of a steel adherend on cleavage strength was examined and an attempt made to relate the surface roughness parameters of average roughness and linear profile length to the cleavage strength. 6 refs.

CIBA-GEIGY

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.838225

Item 98

Structural Adhesives in Engineering VI. Conference
Proceedings.

Bristol, 4th-6th July 2001, p.143-7, 012

**EFFECT OF LOAD ON THE DURABILITY OF
ADHESIVELY BONDED LAP SHEAR JOINT OF
AUSTENITE STAINLESS STEEL**

Hakala K; Tiainen T

Tampere,University of Technology

(IOM Communications Ltd.)

An investigation was conducted of the possibility of developing a prediction model for the long-term durability of a single lap shear joint between austenitic stainless steel sheets when the joint was exposed to environmental conditions and to static loading. The adhesives used were commercial epoxy resin and PU adhesives. A critical combination of temp., humidity and load was shown to exist for the studied joints. This critical combination caused an extremely rapid deterioration of joint strength due to ageing. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND;
SCANDINAVIA; UK; WESTERN EUROPE

Accession no.838215

Item 99

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.135-8, 012

ASSEMBLY TECHNIQUE FOR CONTROL PANEL ENCLOSURES WITH THE COMBINED USE OF ADHESIVE AND RIVETS, AND THE REDUCTION OF ENERGY CONSUMPTION

Haraga K; Taguchi K; Nakashima Y

Mitsubishi Electric Corp.; Denki Kagaku Kogyo KK;

Mitsubishi Electric Engineering Co.Ltd.

(IOM Communications Ltd.)

The above assembly technique for sheet metal control panels is described, the adhesive used being a two-part modified acrylic compound, and the functions of the adhesive and the rivets are considered. The reduction of energy consumption achieved using this technique is discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; UK; USA; WESTERN EUROPE

Accession no.838213

Item 100

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.111-7, 012

PULL-OUT BEHAVIOUR OF STEEL RODS BONDED IN TO TIMBER

Broughton J G; Hutchinson A R

Oxford, Brookes University

(IOM Communications Ltd.)

A comprehensive experimental and numerical investigation was conducted into the fundamental material and joint geometry characteristics of steel rods bonded in to timber. Both adhesive type and performance in tension and flexure were considered, together with joint parameters. In particular, the use of thick bondlines, usually avoided in many engineering applications, and counter-boring were investigated due to their potential advantages for practical on-site fabrication requirements. It was found that epoxy resin adhesives out-performed all other types investigated and pull-out strengths could be significantly improved through careful selection and optimisation of the joint geometry. 12 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.838208

Item 101

Structural Adhesives in Engineering VI. Conference Proceedings.

Bristol, 4th-6th July 2001, p.51-61, 012

IMPROVEMENTS IN THE PREPARATION OF SILANES FOR STEEL PRE-TREATMENT

Torry S A; Campbell A; Cunliffe A V; Tod D A

QinetiQ

(IOM Communications Ltd.)

The use of gamma-glycidoxypropyltrimethoxysilane in the pretreatment of metal surfaces prior to the formation of an adhesive joint was investigated. A 1% solution of silane in 95% ethanol and 4% water hydrolysed at extremely low rates. Addition of glacial acetic acid did not accelerate the reaction. Several metal acetylacetonate and alkyl tin esters were found to catalyse the hydrolysis reactions. The two best catalysts, dibutyltin dilaurate (DBTDL) and dibutyltin diacetate, catalysed the hydrolysis process at rates which were similar to that observed for the GPC hydrolysis in acidified water. Proton NMR spectroscopy identified silanol intermediates, confirming that the hydrolysis of GPC was a stepwise reaction. In the case of DBTDL, the hydrolysis was attenuated until the DBTDL had hydrolysed to the active catalyst species. Silicon-29 NMR confirmed that, post hydrolysis, the silanols slowly condensed to form oligomeric species. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.838197

Item 102

Shawbury, Rapra Technology Ltd., 2001, pp.x, 303, 29cm, 921

TOXICITY AND SAFE HANDLING OF DI-ISOCYANATES AND ANCILLARY CHEMICALS: A CODE OF PRACTICE FOR POLYURETHANE FLEXIBLE FOAM MANUFACTURE AND ELASTOMER MANUFACTURE

(Rapra Technology Ltd.; British Rubber Manufacturers Assn.)

This handbook provides detailed working procedures for those exposed to isocyanates and other chemicals used in flexible foam manufacture, supplying hazard data for individual chemicals and recommending handling practices. This second edition provides the most up-to-date information regarding topics covered in the first edition and also includes a code of practice for the manufacture of polyurethane elastomers using MBOCA.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.836995

Item 103

Adhesives & Sealants Industry

8, No.4, May 2001, p.46-7

TRUCK TONNEAU COVERS BONDED WITH POLYURETHANE

Truck Accessories Group Inc.

Details are given of the use of Arathane AW 8680 PU adhesive to join ABS and high-impact Telene thermoplastic panels for a tonneau cover for pickup trucks.

USA

Accession no.835548

Item 104

Industria della Gomma

45, No.1, Jan./Feb.2001, p.16-21

Italian

ADHESIVES AND TECHNOLOGIES FOR COST REDUCTION

Alberts H; Rooke M B; Giannone C
Henkel KGaA; Henkel Industrial Adhesives Ltd.;
Henkel Loctite Adesivi

The properties of Henkel's Chemosil adhesives and their applications in rubber-to-metal bonding are examined. The various stages of the bonding process are described, and measures for the reduction of costs are discussed in relation to storage times and conditions, type of adhesive used (solvent-based or water-based), surface preparation of metals, application of the adhesive to the metal, and conditions used in moulding processes.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
ITALY; UK; WESTERN EUROPE

Accession no.835424

Item 105

Machine Design

73, No.20, 25th Oct. 2001, p.90

ADHESIVES HOLD ELECTRIC MOTORS TOGETHER

Brief product details are given of a range of adhesive products and fasteners from Loctite for use on electric motors in vehicles. Recent additions include Durabond epoxies and urethanes that bond structural metal and plastic components; Proform hot melts for bonding engineering plastics; and Encap potting and encapsulating compounds. Loctite 3920 is a new acrylic adhesive which dampens noise on magnet bonding and bearing mounting in electric fans.

LOCTITE CORP.
USA

Accession no.834256

Item 106

International Polymer Science and Technology

28, No.8, 2001, p.T/24-33

ADHESION OF RUBBER TO METAL

Ikeda Y

The bonding of rubbers to metals during vulcanisation is reviewed, with respect to individual technological developments and the outputs of research, with particular emphasis on the direct bonding of rubber to various metals or alloys during vulcanisation. Experimental results discussed indicate that the important adhesion factor in direct vulcanisation bonding is the formation of a sulphide layer at the interface due to reaction of the metal with sulphur in the rubber, and that some interaction occurs between this sulphide layer and rubber. 50 refs. (Article translated from Nippon Gomu Kyokaishi, No.4, 2000, p.180).

JAPAN

Accession no.834235

Item 107

MECHANICAL BEHAVIOUR OF ADHESIVE JOINTS: ANALYSIS, TESTING AND DESIGN.

Proceedings of the Euromech Colloquium 358, held Nevers, 4-6th September 1997.

Paris, Editions Pluralis, 1997, Paper 34, p.361-375. 012

DESIGN AND ANALYSIS ASPECTS OF ADHESIVE JOINTS IN DRIVE TRAIN APPLICATIONS

Romanos G

Loctite Research Development & Engineering Group
(European Mechanics Society)

The use is discussed of adhesive technology in load bearing drivetrain applications, and the need for credible design and analysis techniques is addressed. This paper outlines essential limitations concerning the evaluation of material properties as well as the prediction of the load capacity of bonded hybrid joints. Simplified approaches in predicting static and fatigue load capacity are given, and in-situ evaluation of the material behaviour is described. A summary is given of industrial experiences with adhesive joints in drivetrain applications. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
GERMANY; WESTERN EUROPE

Accession no.830762

Item 108

MECHANICAL BEHAVIOUR OF ADHESIVE JOINTS: ANALYSIS, TESTING AND DESIGN.

Proceedings of the Euromech Colloquium 358, held Nevers, 4-6th September 1997.

Paris, Editions Pluralis, 1997, Paper 25, p.277-283. 012

THERMOMECHANICAL CHARACTERIZATION OF MIXED METAL-PLASTIC JOINTS

Fuseau C; Vrillac P; Roy A; Gacougnolle J L
France Design; CRITT Materiaux; ENSMA
(European Mechanics Society)

The mechanical properties of an SMC composite and polyurethane adhesive are examined, followed by an analysis of the mechanical behaviour of SMC/polyurethane/aluminium joints determined as a function of the temperature at different crosshead speeds. Depending on the tests temperatures, three failure modes are noted: below 0 degrees C, the failure is adhesive at the aluminium/polyurethane interface, below -10 degrees C and 60 degrees C, the fracture occurs by delamination of SMC, and above 60 degrees C, the failure is cohesive in polyurethane near the aluminium/polyurethane interface.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.830753

Item 109

Adhesives Age

44, No.9, Sept.2001, p.s10

STICKING WITH A WINNER

Schwartz J

For the transportation industry, Loctite Automotive believes it can offer an adhesive or sealant that can replace any mechanical device. Adhesives are used in automotive, marine, commercial trucks and recreational vehicles. Examples of their use in cars are body, door and trunk assembly. Experts say adhesives are often less expensive to use and require less manpower than welding and other forms of bonding. 3M recently developed a product called Scotch-Weld Adhesive DP-8005, which can be used to bond low-surface energy plastics to dissimilar plastics as well as to steel, aluminium, concrete, glass and wood.

USA

Accession no.829675

Item 110

Adhesives Age

44, No.9, Sept.2001, p.s9

DRIVING FOR PROFITS

Schwartz J

More and more adhesives, sealants and tapes are being used in the transportation industry in end uses such as car, boat and truck assembly. Experts say that adhesives have an advantage because they are often less expensive to use and require less manpower than welding and other forms of bonding. A second advantage adhesives offer over metal fasteners is that they can reduce noise, vibration and vehicle weight. One adhesives technology that is branching out into recreational vehicles, in particular, is reactive hot melts. When it comes to adhering metal to metal and plastic to metal, such as in the marine industry, glue is seen as a viable bonding option. In transportation, environmental compliance is a major consideration when companies are looking for a bonding method. To that end, adhesives makers are supplying more water-based and non-VOC-based adhesives.

USA

Accession no.829674

Item 111

International Journal of Adhesion & Adhesives

21, No.4, 2001, p.287-96

OPTIMUM PREPARATION OF SILANES FOR STEEL PRE-TREATMENT

Cunliffe A V; Evans S; Tod D A; Torry S A; Wylie P DERA

The use of a silane coupling agent in a rocket motor bonding process was studied, particular attention being paid to the rate of hydrolysis of the silane in aqueous and ethanolic solutions, which was thought to be a key process in the application of the silane coupling agent during

fabrication. The rate of hydrolysis of gamma-glycidioxypropyltrimethoxysilane was measured by proton NMR spectroscopy. Results were obtained for aqueous solutions and a range of ethanolic solutions with various amounts of water. The dependence of the rate on pH and concentration was investigated. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.829492

Item 112

Journal of Applied Polymer Science

81, No.11, 12th Sept.2001, p.2696-701

POLYESTERAMIDES USED FOR HOT MELT ADHESIVES: SYNTHESIS AND EFFECT OF INHERENT VISCOSITY ON PROPERTIES

Xuming Chen; Hua Zhong; Lanqin Jia; Jiacheng Ling; Ruiguo Tang; Jinliang Qiao; Zhongyue Zhang Beijing, Research Inst. of the Chemical Industry

Correlation between inherent viscosity and a series of thermal, mechanical and adhesion properties including melt viscosity, softening point, heat of fusion, glass transition temperature, low temperature flexibility, tensile strength, elongation at break, hardness, lap shear strength and T-peel strength for a series of polyesteramides based on different acids (dimer acid and sebacic acid) and amines (ethylenediamine and diethylene glycolamine), was examined. Polymers were characterised using infrared spectroscopy. It was found that as inherent viscosity increases the melt viscosity, tensile strength, elongation at break and lap shear strength increase, but other properties including softening and glass transition temperatures, and hardness show no significant change. Standard test methods were utilised wherever possible, and adhesive strengths were determined using aluminium as the adherent. 11 refs.

CHINA

Accession no.829372

Item 113

European Design Engineer

Oct.2001, p.50-1

CONDUCTIVE ADHESIVES PROVIDE SOLUTION TO ELECTRONIC ASSEMBLY PROBLEMS

Yallop C

RFI Shielding Ltd.

Design engineers are continually faced with the same recurring dilemmas: how to seal electronic enclosures effectively against the elements, the need to engineer out increasingly costly and often difficult assembly operations, and how to shield their electronic equipment from radio frequency and electromagnetic interference (RFI/EMI). The importance of shielding technologies has been increasingly emphasised in recent years, mainly because of the introduction of EMC legislation in all major

industrial countries. These measures are intended to ensure that every item of electronic equipment produced or sold in these areas is adequately shielded from emitting or being affected by RFI/EMI, an essential criteria for reliable and safe functionality. RFI Shielding has recently formulated and released a range of conductive adhesives specifically designed for resolving electronic assembly problems, while ensuring EMC compatibility. Details are given of Bondshield high strength adhesives that are highly conductive, temperature resistant and give effective long-term reliability.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.828973

Item 114

Macplas

25, No.223, Nov.2000, p.98-100

Italian

ADHESIVES FOR THE THIRD MILLENNIUM

Plaszynski T

Lord Corp.

A review is made of developments in adhesives for use in rubber-to-metal bonding, including solvent-based, water-based and 100% solids formulations. Consideration is also given to the selection of adhesives to meet the requirements of different rubbers and substrates, factors influencing adhesion, and methods used in the surface preparation of metals for bonding.

USA

Accession no.828687

Item 115

Industria della Gomma

44, No.10, Dec.2000, p.37-42

Italian

WHEN RUBBER HAS A HEART OF METAL

De Tuoni E

A review is presented of aspects of rubber-to-metal bonding discussed at a conference held in Milan by Assogomma on 27th November 2000. These included developments in primers and water-based adhesives, methods for the surface preparation of metal substrates, techniques used in testing, analysis and quality control, approaches to the prevention of bond failure problems, and the bonding of thermoplastic elastomers to metals and other substrates.

ASSOGOMMA

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE; WORLD

Accession no.828668

Item 116

Adhasion Kleben & Dichten

42, No.9, 1998, p.17/21

German

EPOXY RESIN - THE MATERIAL THAT DREAMS ARE MADE OF

Sippl C

Weidling

In many cases gluing facilitates repairs on damaged components from the widest range of materials. The most important advantages of gluing repairs manifest themselves in the favourable relationship of repair costs to acquiring new components and the reduction in stoppage times. In these cases, an application of adhesives based on epoxy resins is preferred. By using examples like pump casings, transport safety, pipework and aluminium blocks, this article shows that it is only a fantasy to suppose there are limits on wide-ranging possible uses of filled epoxy resins.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.823358

Item 117

Adhesives & Sealants Industry

8, No.3, April 2001, p.80

METHACRYLATE ADHESIVES BOND NEW COMPOSITE GRID TO BOAT HULL

ITW Plexus; Thunderbird Products

Thunderbird Products have selected Fiberglass Fusion Adhesives from ITW Plexus to bond a glass fibre /epoxy structural grid to the inside of the hull of its Formula high-performance boats. The advanced methacrylate adhesives were chosen because they eliminate the surface preparation and priming required with PU adhesives.

USA

Accession no.820357

Item 118

Adhesives & Sealants Industry

8, No.3, April 2001, p.32

ADHESIVE SYSTEM ENDS STRESS CRACKING IN CATHETER ASSEMBLY

Loctite 3211 medical device adhesive has successively been used to bond stainless steel needle halves to lightly tinted polycarbonate wings in a soft, flexible catheter assembly used on patients with fragile veins. This UV curing adhesive system has replaced a solvent-based adhesive previously used for this application. A combination of this UV curing adhesive and a Loctite light-cure chamber has eliminated stress cracking and reduced rejects arising from the use of the solvent-based adhesive.

LOCTITE CORP.

USA

Accession no.820346

Item 119

Adhesives & Sealants Industry

8, No.5, June/July 2001, p.80

LOCTITE PRODUCTS AID IN DESIGN OF RACE CARS

The use is reported of Loctite adhesives on the West McLaren Mercedes MP4-15, which amounts to more than 80 different applications of Loctite products. In particular, details are given of two new applications which use Loctite 648 high strength retaining compound and Loctite 5368 flexible silicone adhesive. The application for the first product is to fasten the floor skids which were previously joined by screws, but which were loosening due to high vibration. The second product is used to bond gauze to the opening of ventilation chimneys to prevent debris from the track entering the chimneys.

LOCTITE CORP.; MCLAREN INTERNATIONAL
USA

Accession no.820137

Item 120

(Reprint, Adhesives Age, Dec. 1997), pp.6. 27 cms. 26/6/01

STRUCTURAL BONDING OF THERMOPLASTICS AND COMPOSITES

Loven W E
ITW Plexus

The structural bonding of assemblies using adhesives is discussed, with reference to the automotive and marine industries. This article examines case history where adhesives have been used for structural bonding by leading manufacturers and identifies critical design and process control criteria for successful bonding applications. It also discussed related contemporary issues in manufacturing operations involving adhesives.

USA

Accession no.820109

Item 121

Adhasion Kleben & Dichten

42, Nos.7-8, 1998, p.20/6

German

SPECIAL VEHICLE CONSTRUCTION: GLUING AS AN ALTERNATIVE TO RIVETING OR WELDING

Henkel-Teroson GmbH

Technical adhesives applications in special vehicle body construction offer very impressive evidence of the performance capabilities of modern adhesive systems. In shipbuilding for example, not only plates but also rows of seats have recently been glued in place without any slipping. A further interesting application is the production of cooler insulation boxes for transporting contents in cool temperatures. This article describes the criteria for deciding on appropriate adhesives technology and the advantages compared with conventional jointing methods used.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.820015

Item 122

Adhesive Technology

18, No.2, June 2001, p.13/6

GOING MOBILE

Two years on from the opening of its Irish facility, Adhesives Research Europe is part of the boom in pressure-sensitive adhesive tapes. With production running at 450 million units per year, the mobile phone market clearly has its own distinctive set of service requirements. ARE addressed this by developing three PSA films for use in battery pack assemblies and mobile phone handsets. ARclad 8313 and 8901 and ARclad DEV-7992 are double-sided acrylic PSAs. ARE has launched two new products which aid construction, without effecting the electrical performance of resistance touch screens and similar electronic devices. Designated ARclean 8769 and 8855, they are electronically clean PSA systems for perimeter spacer bonding.

ADHESIVES RESEARCH EUROPE

EUROPEAN COMMUNITY; EUROPEAN UNION; IRELAND;
WESTERN EUROPE

Accession no.819083

Item 123

Kettering, 1999, pp.1. 29 cms. 26/6/01

BOSTON WHALER MAINTAINS ITS UNSINKABLE REPUTATION WITH PLEXUS ADHESIVES

ITW Plexus

Plexus 'Fiberglass Fusion' adhesives are toughened structural methacrylate adhesives that are claimed to provide exceptionally tough bonds and superior flexibility, durability, and resistance to impact, fuels, chemicals, UV and water. Their use in Boston Whaler boats is briefly described, where they are used to bond superstructures to the fibreglass hull.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA;
WESTERN EUROPE

Accession no.818898

Item 124

Kettering, 2001, pp.1. 29 cms. 26/6/01

PLEXUS - ANOTHER IDEAL SOLUTION

ITW Plexus

Plexus MA420 adhesive was chosen by Alstom Transport for use in the installation of a floating floor in the Coradia diesel multiple unit, manufactured for First Northwestern. A brief case history is presented of this particular application in which phenolic composite panels had to be bonded to an extruded aluminium framework. Plexus MA420 is claimed to have provided the necessary

characteristics of strength, impact strength, flexibility and resistance to chemicals, UV and temperatures.

ALSTOM TRANSPORT; FIRST NORTHWESTERN EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.818897

Item 125

Patent Number: EP 1095975 A2 20010502

FLAME-RETARDANT ADHESIVES AND CIRCUIT MATERIALS WITH THE USE OF THE SAME

Kuniyoshi A; Fujii T; Kumakura M
Sony Chemicals Corp.

Disclosed are flame-retardant adhesives for circuit materials, which are harmless to the environment, exhibit excellent thermo-humidity resistance, electrical properties and high flame retardancy. They contain a saturated polyester resin and a flame retarder containing a component having a P-C bond in its molecule and a component having nitrogen in its molecule, the content of the flame retardant amounting to 90 parts by weight or more per 100 parts by weight of the saturated polyester resin.

EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN; WESTERN EUROPE-GENERAL

Accession no.818774

Item 126

Macromolecular Materials and Engineering

286, No.3, 30th March 2001, p.191-5

ADHESIVE PROPERTIES OF EPOXY RESIN WITH CHROMIC HARDENER

Novak I; Simonikova J; Chodak I
Slovak Academy of Sciences

The cohesive and adhesive properties were studied for epoxy resins crosslinked either with a hardener based on a chelated complex of chromium with an organic acid or with a conventional amine hardener. Higher cohesive parameters such as yield strength, Young's modulus and impact resistance were observed for epoxy resin cured with the chromic hardener and the adhesive strength of steel-aluminium joints was higher for the chromic-containing epoxy resin. 10 refs.

SLOVAK REPUBLIC; SLOVAKIA

Accession no.813971

Item 127

Journal of Materials Science Letters

20, No.4, 15th Feb.2001, p.375-9

EFFECT OF THE PHASE SEPARATION ON FRACTURE BEHAVIOR OF RUBBER-MODIFIED EPOXY ADHESIVES

Byoung Un Kang; Jae Young Jho; Junkyung Kim; Sang-Soo Lee; Min Park; Soonho Rim; Chul Rim Choe
Seoul,National University; Korea,Institute of Science & Technology

The effect of the phase separation on the fracture behaviour of rubber-modified epoxy resin adhesives was investigated, using DGEBA-based epoxy resins and four types of rubber modifiers, i.e. two types of carboxyl-terminated butadiene-acrylonitrile copolymers with 17 (CTBN8) and 27 wt % acrylonitrile, a core-shell polybutyl acrylate-PMMA rubber and a polybutylene terephthalate-polytetramethylene glycol copolymer. The experimental evidence supported the mechanism of the CTBN8 rubber agglomeration at the metal/adhesive interface as a major factor in influencing fracture energy. The adhesives with the other rubber modifiers did not exhibit agglomeration at the adhesive/aluminium interface and failed in cohesive mode with relatively higher fracture energy than that of the CTBN8-containing systems which failed in interfacial mode. 19 refs.

KOREA

Accession no.813781

Item 128

Journal of Advanced Materials

33, No.2, April 2001, p.70-81

UV ACTIVATED ADHESIVE FOR ALUMINIUM BONDED REPAIRS

Chan-Park M B; Haghiglat R
SiPix Imaging Inc.; Triton Systems Inc.

A need currently exists for a structural adhesive which is long term storable, low temperature curable, vacuum processable and good for 82 deg.C service. Photochemically latent cationic photoinitiators are explored as catalysts. Epoxy formulations using Irgacure 261 from Ciba, which is a ferrocenium salt, show good shelf lives at 49 and 32 deg.C up to 150 days. On UV activation, a Lewis acid is produced; this has good latency at room temperature, allowing laying up of aluminium substrates for bonding. At a curing temperature of 93 deg.C for three hours, the UV activated samples containing 1.1 wt.% of Irgacure 261 show complete cure as evidenced by differential scanning calorimetry. Single lap shear strengths of about 24 MPa are achieved using properly prepared aluminium substrates. 6 refs.

USA

Accession no.810922

Item 129

Pittura e Vernici

77, No.2, 1st-15th Feb. 2001, p.49-56

BONDING AND SEALING SYSTEMS IN THE LEISURE BOAT AND GENERAL MARINE INDUSTRY

Sallustio C
Sika Italia

Optimum methods of sealing joints using elastic bonding/sealing systems and the characteristics of such systems for the construction of boats are considered. Mechanisms of adhesion, joint design, surface treatment procedures

and application conditions for primers are described and handling and curing is briefly discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE

Accession no.809172

Item 130

Chemical Week

163, No.12, 21st March 2001, p.28

KEEPING IT CURRENT

Schmitt B

The market for electronics adhesives and current trends within this adhesives sector are briefly discussed. The effect of a slowdown in semiconductor manufacture on the adhesives sector is considered as is the impact of efforts to eliminate lead from electronic manufacture on the adhesives industry.

USA

Accession no.809148

Item 131

Adhasion Kleben & Dichten

42, No.5, 1998, p.16/20

German

**FLIP-CHIP UNDERFILLING WITH
PHOTOINITIATED ADHESIVES**

In flip-chip technology the post-contact gap between a component and the carrier material has to be filled with a resin. These so-called underfill compounds not only have the task of increasing the adhesion of the chip on the substrate, but must also minimise mechanical stress situations and protect the signal-carrying structures from corrosion. This report looks at the advantages of photoinitiated adhesives, as well as basic properties of underfillers and underfilling with hot curing, with subcuring of light-curing epoxy resins using glass, polycarbonates or PVC, and with top curing.

DELO INDUSTRIEKLEBSTOFFE GMBH & CO.KG

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.807530

Item 132

Advanced Materials

13, No.2, 16th Jan.2001, p.95-108

**MOLECULAR LUBRICANTS AND GLUES FOR
MICRO- AND NANODEVICES**

Tsukruk V V

Iowa State University

Recent developments in molecular coatings from functional polymeric and organic molecules designed as molecular lubricants or molecular glues for micro- and nanodevices are discussed, with particular attention to organised molecular films from amphiphilic molecules, molecules with reactive ends and functional oligomers.

The interfacial properties of molecular coatings which are critical for their lubrication or adhesive performance at the nanoscale are discussed in conjunction with results on molecular structure and morphology of these coatings. Examples of the latest developments in the field of nanocomposite molecular coatings and applications of molecular lubrication concepts for computer hard drives are presented. 134 refs.

USA

Accession no.807410

Item 133

Adhasion Kleben & Dichten

42, No.4, 1998, p.12/6

German

**BONDING COMMUNICATIONS AND ENERGY
CABLES**

Butterbach R; Kopannia S; Maassen U; Wichelhaus J
Henkel AG

Under today's quality requirements such as durability and reliability, the most extremely complex construction of modern cable structures can only be achieved by using hot melt adhesives. As is well known, we do not have to wait for a chemical reaction during their use compared with other types of adhesive, so that they are seen as especially suitable for continuous, fast production processes. This article looks at PE applications, water treeing effect, insulating high- and low-voltage cables and the effects of temperature, as well as hot melt adhesives based on thermoplastic elastomers, energy and telecommunications cabling, viscoelastic behaviour, polyamide structures and light wave conductive cabling. The combination of different monomers with dimer fatty acids allows the production of tailor-made polymers. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.803780

Item 134

Ambler, Pa., 2000, pp.3. 27 cms. 26/1/01

CAPCURE LOF

Cognis

Technical product details are given for Capcure LOF low odour, uncatalysed polymercaptan epoxy curing agent. The low odour, low-skinning curing agent has been designed specifically for less skinning of filled hardeners. It can also be used in low odour, skin resistant clear formulations, and as either sole curing agent or as accelerator for amine, amide or amido-amine chemistries in adhesive and coating applications. Its fast-setting characteristics over a wide temperature range offers uses in industrial coatings, civil engineering and fast-set adhesives.

USA

Accession no.801436

Item 135

West Conshohocken, Pa., 2000, pp.4. NALOAN
**ASTM D 3156-. TEST METHOD FOR STRENGTH
PROPERTIES OF ADHESIVES IN SHEAR BY
TENSION LOADING OF SINGLE-LAP JOINT
LAMINATED ASSEMBLIES**

American Society for Testing & Materials
ASTM D 3165-

Version 2000. Photocopies and loans of this document
are not available from Rapra.

USA

Accession no.801047

Item 136

Philadelphia, Pa., 2000. NALOAN
**A-A-56015.ADHESIVE SYSTEM, EPOXY, FOR
DISSIMILAR METAL BONDING**

US Military
A-A-56015

Version A Notice 1. Photocopies and loans of this
document are not available from Rapra.

USA

Accession no.801024

Item 137

High Performance Polymers
12, No.4, Dec.2000, p.497-514
**ADHESIVE CHARACTERISTICS OF ALDER-
ENE ADDUCT OF DIALLYL BISPHENOL A
NOVOLAC AND BISPHENOL A BISMALEIMIDE**

Gouri C; Nair C P R; Ramaswamy R
Vikram Sarabhai Space Centre

The adhesive characteristics (lap shear strength and T-peel strength) of a bismaleimide-allylphenol reactive blend, based on bisphenol A bismaleimide and an allyl functional phenol novolac resin (diallyl bisphenol A-formaldehyde), were studied. The effect of matrix toughening, by incorporating some selected thermoplastics, on the adhesive and thermo-adhesive profile (on aluminium adherends) and their correlation with morphological features was also examined. 25 refs.

INDIA

Accession no.800721

Item 138

Patent Number: US 6103851 A1 20000815
**HIGH SERVICE TEMPERATURE
POLYURETHANE COMPOSITIONS**

Roser J-L; Sood R L; Storione A
Dow Chemical Co.

The invention is polyurethane compositions useful in high temperature service environments comprising A) i) one or more polyols having hydroxyl functionality of 3.0 or greater and a weight average molecular weight of about

2000 to about 6000 wherein the polyols are the reaction product of an initiator or mixture of initiators having an average functionality of 4 or greater and one or more alkylene oxides; or ii) a) one or more polyols having hydroxyl functionality of 3.0 or greater and weight average molecular weight of greater than about 4000 wherein the polyols are the reaction product of an initiator or mixture of initiators having an average functionality of 4 or greater and one or more alkylene oxides, and b) one or more crosslinkers having an equivalent weight of about 200 or less; B) an organic isocyanate; and C) a catalyst for the reaction of an isocyanate with an active hydrogen containing compound; wherein the ratio of isocyanate moieties to active hydrogen containing moieties is from about 0.9:1.0 to about 1.5:1.0. The compositions of the invention can be processed at relatively low temperatures to form high heat service temperature compositions useful as adhesives, sealants, encapsulants, gaskets or elastomers.

USA

Accession no.800494

Item 139

Kunststoffe Plast Europe
90, No.12, Dec. 2000, p.14-6. (Translated from
Kunststoffe 90 (2000), 12, p.40-3)

SELF-CONTAINED CHEMICAL FACTORY
Mullenberg L
3M Deutschland GmbH

Problems relating to the bonding of PE pipes to a stainless steel sleeve in the design of the Quadro-Sicura BP-N house service connection module for the installation of utilities in the floors of buildings are described. Various mechanical jointing methods were employed, and the high costs of pre-treatment prior to adhesive bonding were not acceptable. Finally, Doyma GmbH, the manufacturer of the module used the new 3M Scotch-Weld DP 8005 structural adhesive from 3M. It is an acrylate-based, tough-elastic, two-component structural adhesive which requires no surface pre-treatment. Advantages are given of its use.

DOYMA GMBH & CO.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.799407

Item 140

Adhesion Kleben & Dichten
42, No.3, 1998, p.30-2

German

**ARE METAL ADHESIVES STABLE AGAINST
COOLING LUBRICANTS?**

Kleinert H; Hadlich G; Gehrke J
Dresden, Technische Universitat

Today adhesives are pressing forward increasingly in areas of application that were closed to them until recently.

The machine base for a machine tool that has been manufactured until now by welding offers an interesting example of this development. This study examines whether it is now possible to construct such a machine base by using adhesion techniques.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.799255

Item 141

West Conshohocken, PA, 2000, pp.17. NALOAN.

ASTM D 5572-. SPECIFICATION FOR ADHESIVES USED FOR FINGER JOINTS IN NONSTRUCTURAL LUMBER PRODUCTS

American Society for Testing & Materials

ASTM D 5572-

Version 95(R1999). Photocopies and loans of this document are not available from Rapra.

USA

Accession no.796569

Item 142

SAMPE Journal

36, No.1, Jan./Feb.2000, p.30-41

DEVELOPMENT OF COMPOSITES, ADHESIVES AND SEALANTS FOR HIGH-SPEED COMMERCIAL AIRPLANES

Hergenrother P M

US,NASA Langley Research Center

A report is presented on research conducted by NASA over the past five years in order to develop composites, adhesives, titanium alloy surface treatments and sealants for a Mach 2.4 High-Speed Civil Transport(HSCT) aircraft. Prepreg and adhesive material forms based on PETI-5 (formed from reaction of 3,3',4,4'-biphenyltetracarboxylic dianhydride, 3,4'-oxydianiline, 1,3-bis(3-aminophenoxy)benzene and 4-phenylethynylphthalic anhydride) were developed to provide large quality composite and sandwich panels. Progress was made in sealants, particularly in fluorosilicone technology, but no sealants were developed which provided the combination of properties required to meet Mach 2.4 HSCT requirements. 28 refs.

USA

Accession no.795915

Item 143

Proceedings of the National Science Council Republic of China

24, No.6, Nov.2000, p.496-501

EVALUATION OF ADHESIVE BONDED JOINTS USING LASER-INDUCED ULTRASOUND

Yang S-K

National Sun Yat-Sen,University

The effectiveness of a laser-ultrasound technique was assessed for evaluating two adhesive joints made from a

7.5-mm thick steel plate and a thin aluminium plate bonded with epoxy resins, one being perfectly bonded and the other being bonded with a simulated defect. Samples were tested using surface waves launched thermoelastically using a Q-switched Nd:YAG pulsed laser and surface waves launched by a piezoelectric transducer and the results obtained using the above procedures compared. Adjustments to the laser-ultrasound technique, including shortening of the rise time of the signal and addition of an optical slot to the laser system, provided a satisfactory procedure for the non-destructive testing of the joints. 11 refs.

TAIWAN

Accession no.795897

Item 144

Adhesives Age

43, No.10, Oct.2000, p.46

'KEEP ON TRUCKIN'

Schwartz J

The development of a two-part, modified epoxy resin adhesive, called Plastilock 731-SI, for bonding General Motors's truck box into place is highlighted. The advantages of this adhesive, which cures at elevated temperatures in one minute and has a pot life of 1.5 hours at room temperature, for such an application are briefly discussed and some information on the truck box, which is made from advanced glass fibre-based composites by structural reaction injection moulding, is provided.

SIUA ADHESIVES

USA

Accession no.794648

Item 145

Torrington, Ct., c.2000, pp.6. 30 cms. 23/11/00

DISCOVER THE DYNAX DIFFERENCE

Dymax Corp.; Intertronics

Adhesive products and curing equipment from Dymax are designed with productivity in mind. Typical applications and features are described for Dymax Multi-Cure and Light-Weld adhesives. Both can be used for encapsulation, and in potting applications, the fast-curing UV adhesives can replace slower setting agents resulting in increased productivity. The Multi-Cure adhesives can be used for metal bonding, and have a fixture time of less than 30 seconds. Dymax Light-Weld adhesives for glass and plastic are transparent, and UV cure in less than 5 seconds. The company's one-part UV coatings can be used to replace slower setting heat-cure, solvent-based or mixed coatings, and cure in less than 5 seconds, enabling line speeds of up to 6 ft to 12 ft a minute to be achieved using high intensity UV lights.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA; WESTERN EUROPE

Accession no.794257

Item 146

Torrington, Ct., 1999, pp.6. 29 cms. 23/11/00

MD MEDICAL DEVICE ADHESIVES SELECTOR GUIDE

Dymax Corp.

A selection guide to medical adhesives and curing and dispensing equipment therefor is presented from Dymax Corp. The range includes MD light curing adhesives and Medi-Cure cyanoacrylates for medical device assembly, and the Dymax MD 1000 series of ultra-fluorescing adhesives for in-line inspection. An adhesive/substrate bonding guide is included.

USA

Accession no.794256

Item 147

Torrington, 2000, pp.6. 27 cms. 17/11/00

DYMAX ENGINEERING ADHESIVES FOR ENVIRONMENTALLY RESPONSIBLE METAL, GLASS AND PLASTIC ASSEMBLY

Dymax Corp.

Properties and features are described for the Dymax range of engineering adhesives for the bonding of metals, glass and plastics. The Dymax 600, 400 and 3000 series are all tailored to enhance automation and reduce processing costs. Details are given of grades within each series. The 600 series are structural adhesives for rugged bonding, sealing, tacking and potting applications. The 400s series are high clarity adhesives for glass, optical and fibre optic assembly operations, and the 3000 series include cationic UV curable epoxies, and grades for plastic bonding. An adhesive substrate selector guide is included.

USA

Accession no.792464

Item 148

Pigment & Resin Technology

29, No.5, 2000, p.310-11

HIGH-STRENGTH, HIGH-TEMPERATURE EPOXY ADHESIVES

Product information is given for three new high strength adhesives from Ciba Specialty Chemicals. Two are epoxy adhesives, formulated for use at temperatures of 250 degrees F and 300 degrees F. These are designated Epibond 1595-A/B and Epibond 1590 A/B respectively. These structural paste adhesives are designed for bonding metals, composites and dissimilar materials. The third is Uralane 6100-A/B, a clear urethane, which can be applied to substrates without surface preparation. It is designed to produce durable, invisible bondlines in the assembly of signs, optical devices, computer components and aircraft parts. Performance data are given for the adhesives.

CIBA SPECIALTY CHEMICALS

Accession no.792451

Item 149

Torrington, Ct., c.2000, pp.6. 28cms. 12/10/2000

ADVANCED ELECTRONICS ASSEMBLY

Dymax Corp.

Information is presented on Dymax products for advanced electronics assembly. Low-temperature surface mounting adhesives are available for improved assembly quality, as well as peelable or water soluble masking products designed for the masking of PC boards prior to soldering or conformal coating. A wide range of solvent-free coatings, potting compounds, and encapsulants is offered, together with Light-Weld adhesives for instant wire and component bonding. Other products include structural adhesives for the high-strength bonding of dissimilar substrates, and UV curing and welding equipment.

USA

Accession no.791877

Item 150

Kettering, 2000, pp.14. 30cms. 12/10/2000

PLEXUS STRUCTURAL ADHESIVES

ITW Plexus

A collection of information is presented on Plexus high performance structural adhesives, which offer a combination of convenience, ease of use and high mechanical strengths for the bonding of engineered plastics, composites and metals. The environmentally adhesives contain less than 1% VOC and are 100% recyclable. Other advantages include their suitability for use over a wide temperature range, good gap filling capabilities, and aesthetically acceptable surface finishes. A series of case histories provides examples of successful use of Plexus adhesives in applications such as boatbuilding, train interiors, and automotive component bonding. A selector guide provides performance data for each Plexus grade and gives guidelines for safe use.

LEISURE TRAVEL VANS LTD.; NORTSHORE YACHTS LTD.; BOSTON WHALER INC.; GILLIG CORP.; ALSTOM TRANSPORT
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.791867

Item 151

Adhesives Age

43, No.9, Sept.2000, p.33/7

ONE SIZE DOES NOT FIT ALL

Kardan M

Clifton Adhesive Inc.

A guideline is established for adjusting the parameters in rubber-based adhesives for better adhesion to substrates. The study includes the measurement of bond strength between polyisoprene and different metallic surfaces by means of the adhesion peel test, and correlates the molecular orientation and structural changes of the

polymer with these forces. Infrared spectroscopy is used to investigate these structural changes. Due to the similarity in structure between polyisoprene rubber and many other rubbers, the structural information gained from the spectroscopic analysis of this system, can be transferred to other elastomer-based substrate systems as well. 10 refs.

USA

Accession no.790267

Item 152

Plastics, Rubber and Composites

29, No.5, 2000, p.243-7

DURABILITY OF CARBON FIBRE REINFORCED POLYETHERETHERKETONE-POLYURETHANE ADHESIVE JOINTS IN AQUEOUS ENVIRONMENTS

Barron V; Buggy M

Limerick,University

As part of a project to develop a biomimetic artificial joint, it is necessary to bond carbon fibre reinforced polyetheretherketone (APC2) to thermoplastic PU. As no qualified adhesives are available, adhesive bonding using hot compression moulding is the chosen methodology. The human body is one of the most aggressive environments that an adhesive bond has to endure. The durability of these APC2 PU joints is investigated in various aqueous environments including Ringer's solution and distilled water. Prior to bonding, the APC2 specimens are exposed to plasma etching and oxidising flame surface treatments to improve adhesion properties. Peel testing reveals that strong and durable bond strengths are recorded and no ageing effects are observed when the adhesive joints are stored in a dry atmosphere for one year. However, when stored in the aqueous media, the bonds rapidly deteriorate to unacceptable levels after seven days. It is found using a variety of techniques, including mass uptake analysis, surface force microscopy and X-ray photoelectron spectroscopy, that the primary mechanism of bond degradation is due to ingress of water by wicking and diffusion. 10 refs.

EIRE

Accession no.789934

Item 153

Adhesion Kleben & Dichten

44, No.5, March 2000, p.19-20

German

PROTECTING ELECTRONIC COMPONENTS WITH HOT-MELT MOULDING

Stuis H

Nordson Deutschland GmbH

In the car and communications industries, with white goods and in the electronics industry, ever greater demands are being placed on the reliability of microelectronics components that are being used. This

development is suited to so-called hot-melt moulding - a low pressure method with which electronic components like plug connectors, sensors and printed circuit boards can be glued, sealed and covered, in order to give them lasting protection from negative effects like heat, dust and moisture. Moulding tools are reviewed along with methods.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.789129

Item 154

Composites Science & Technology

60, No.10, 2000, p.1953-63

PROPERTIES OF INTERFACIAL ADHESION FOR VIBRATION CONTROLLABILITY OF COMPOSITE MATERIALS AS SMART STRUCTURES

Park J M; Kim D S; Han S B

Gyeongsang,National University;

Kyungnam,University

The performance of smart structures depends on the quality of the bonding along the interface between the main structure and the attached sensing and actuating elements. By using interfacial adhesives providing optimum bonding conditions between them, vibrational properties of the composite beams with attached sensor and actuator are investigated. Three different adhesives, i.e. ethyl-2-cyanoacrylate adhesive (A), toughness and stiffness controlled epoxy adhesives (B and C) are compared with each other. An optimal type adhesive is chosen, based on its mechanical and wetting properties. Under severe flexure loading condition, C is found to be most suitable for the vibrational structure system, assuming that the composite beam/adhesive system can deform with the same curvature. In addition, C can provide the optimised bonding for manufacturing the smart structure and transfer the elastic behaviour precisely. In addition, the beam with C provides the fastest response time for vibration control. This means that optimum bonding between composite beam and PZT is formed comparatively using this interfacial adhesive. 18 refs.

CHINA; KOREA

Accession no.787603

Item 155

Patent Number: US 6054213 A1 20000425

PRESSURE SENSITIVE ADHESIVES FOR USE IN LOW TEMPERATURE CONDITIONS

Peacock K; Everaerts A I; Wilson K D; Galick S J

3M Innovative Properties Co.

Acrylate copolymer pressure sensitive adhesives (PSAs), which incorporate relatively small amounts of a plasticiser, are disclosed. They exhibit improved low temperature performance and minimal effect on other properties, when used as adhesives for graphic marking

films. The adhesive system permits the graphic marking film to be applied at temperatures as low as 20F (-7C) and allows the film to be applied to a substrate without trapping air between the marking film and the substrate. The adhesive system is resistant to tenting around the compound curved surfaces of rivet heads and corrugations typical of truck trailer sides.

USA

Accession no.786431

Item 156

Patent Number: US 6069278 A1 20000530

**AROMATIC DIAMINES AND POLYIMIDES
BASED ON 4,4'-BIS-(4- AMINOPHENOXY)-2,2'
OR 2,2',6,6'-SUBSTITUTED BIPHENYL**

Chuang C-H K

US,National Aeronautics & Space Administration

This invention relates to the novel diamines, the polyimide oligomers and the polyimides derived therefrom and to the method of preparing the diamines, oligomers and the polyimides. The thermoplastic polyimides derived from the aromatic diamines of this invention are characterised as having a high glass transition temperature, good mechanical properties and improved processability in the manufacture of adhesives, electronic and composite materials for use in the automotive and aerospace industry. The distinction of the novel aromatic diamines of this invention is the 2,2',6,6'-substituted biphenyl radicals which exhibit noncoplanar conformation that enhances the solubility of the diamine as well as the processability of the polyimides, while retaining a relatively high glass transition temperature and improved mechanical properties at useful temperature ranges.

USA

Accession no.786206

Item 157

Adhesives Age

43, No.7, July 2000, p.26

AUTOMOTIVE

Valero G

Adhesives play an important part in weld-and-fastener reduction programmes in automotive applications. Automotive-related sales were reported at 1.2bn US dollars in 1999. The two fastest-growing automotive applications for adhesives are vehicle assembly and vehicle interior. For the most part, these are 100%-reactive systems or very high-solids reactive systems. One-part adhesive systems, such as epoxies and PUs, are considered the leading formulative technology and will account for 59% of incremental growth in the automotive market during the next five years.

CHEMQUEST GROUP INC.

USA

Accession no.785024

Item 158

International Journal of Adhesion & Adhesives

20, No.5, Oct. 2000, p.377-85

ENVIRONMENTAL DURABILITY OF MOISTURE-CURED URETHANE ADHESIVE JOINTS

Ramani K; Verhoff J; Kumar G; Blank N; Rosenberg S
Purdue,University; Sika Corp.

A low modulus, moisture curing PU adhesive was used to bond hot dipped galvanised steel to fibre-reinforced unsaturated polyester composites and composite to composite. The single lap shear joints obtained were aged by cataplasma, cyclic moisture, QUV, Weather-Ometer and in a convection oven at 60C and tested in a tensile testing machine. The failure strength, energy to fail and failure modes of the aged specimens were recorded after each joint was tested and the main factors contributing to joint degradation and failure evaluated. 13 refs.

USA

Accession no.784324

Item 159

International Journal of Adhesion & Adhesives

20, No.5, Oct. 2000, p.367-76

ADHESIVE BONDING OF AIRCRAFT STRUCTURES

Higgins A

British Aerospace Regional Aircraft Ltd.

The history of and details on adhesives employed in the construction of aircraft are presented. Aspects covered include the main adhesives used, a comparison of the properties of structural adhesives for metal to metal bonding, surface preparation procedures, bonding operations, bond quality assessment and methods for assessing new structural adhesives for aircraft. 9 refs. (Fifth Structural Adhesives in Engineering Conference, Bristol Jury's Hotel, 1-3 April, 1998)

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.784323

Item 160

Wilmington, De., c.2000, pp.8. 28cms. 12/7/2000

BONDING SYSTEMS FOR VAMAC

Hagman J F

DuPont Co.,Elastomers Div.

DuPont EA-450.2

This bulletin describes the effectiveness of several one-coat and two-coat adhesive systems that can be used in fabricating bonded composites of Vamac ethylene/acrylic elastomer and metal or Vamac. The preferred adhesive systems provide rubber tearing bonds to properly prepared substrates using conventional bonding techniques. The best systems also provide good bond stability under dynamic operating conditions, as well as after heat ageing and fluid exposure. 2 refs.

USA

Accession no.783716

Item 161

Reinforced Plastics

44, No.6, June 2000, p.46/50

ADHESIVE BONDING BRINGS LASTING PERFORMANCE

Moussiaux E; Luegering A

Bekaert Composites; Domine Techno-Composites GmbH

It is explained that adhesive bonding of composites can lead to lasting performance - if the job is done properly! This article reviews in detail the advantages and limitations of both bolted and adhesively-bonded connections in pultrusion applications.

EUROPEAN PULTRUSION TECHNOLOGY ASSN.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION;

GERMANY; SCANDINAVIA; WESTERN EUROPE

Accession no.783681

Item 162

Adhasion Kleben & Dichten

44, No.4, March 2000, p.10/5

German

ELECTRICALLY CONDUCTIVE GLUING TECHNIQUES IN CONTRAST

Gesang T; Schaefer H; Hennemann O-D

Fraunhofer-Institut fuer Fertigungstechnik und

Ang.Materialforschung

Electrically conductive glued joints are being applied mainly in microelectronics. Modern structural and jointing technologies must face the advances in building elements and wiring supports accordingly, in order to allow for the fast, cost-effective production of innovative structural components. This study explores available techniques, including isotropically and anisotropically conductive adhesives.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;

WESTERN EUROPE

Accession no.782459

Item 163

Adhasion Kleben & Dichten

44, No.3, March 2000, p.32-5

German

HIGH-TENACITY BONDING WITH NEW NATURAL RUBBER ADHESIVES

Linnenbrink M

New types of natural rubber adhesives have been developed for adhesion techniques on car shells. These are in competition with conventionally used epoxy resin adhesives. The new products can be used for high-tenacity inner lining applications and structural bonding in car shells. This study explores how effective these new natural systems are in comparison with products used hitherto.

TIVOLI KLEBSTOFF GMBH

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;

WESTERN EUROPE

Accession no.782444

Item 164

Adhesives & Sealants Industry

7, No.6, June-July 2000, p.56

ACRYLIC COMPOUND PREVENTS LOOSENING OF AIRCRAFT CABLE-CONNECTOR BACKSHELLS

ND Vibra-Tite, an acrylic adhesive compound was successfully used to repair aircraft cable-connector backshells on an electronic control system of the US Air Force Airborne Command. When such connector backshells are loose, they allow corrosion to develop in the connector causing shielding degradation. ND Vibra-Tite is a thread-locking compound, with cold-flow properties, which dries to the touch in seconds, does not require the parts to be pre-cleaned, and provides a flexible consistency which allows a connector coated with it to be easily adjusted, removed and re-used repeatedly. The material is thick, resilient, and acts as a damping compound, allowing the fastener to absorb vibration.

ND INDUSTRIES INC.

USA

Accession no.779540

Item 165

International Journal of Adhesion & Adhesives

20, No.4, Aug.2000, p.323-31

DURABILITY ASPECTS OF ADHESIVELY BONDED THICK ADHERENT LAP SHEAR JOINTS

Knox E M; Cowling M J

Glasgow,University

The effect of ageing on adhesively bonded thick-adherent steel lap joints in a wet marine environment is studied, with respect to the sensitivity of the epoxy resin adhesive to the effects of water, and the durability of the joint. Accelerated ageing techniques were used. Various simple geometric factors are shown to affect joint performance. Tests were carried out under different conditions including the removal of the spew fillet, the application of a stress, and different joint orientations, to determine their influence on joint performance. It was found that the water affects both the adhesive and the adhesive/adherent interfacial zone. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;

WESTERN EUROPE

Accession no.778567

Item 166

West Conshohocken, PA, 1999, pp.4. NALOAN.

ASTM E 865-. SPECIFICATION FOR STRUCTURAL FILM ADHESIVES FOR HONEYCOMB SANDWICH PANELS

American Society for Testing & Materials

ASTM E 865-

Version 99. Photocopies and loans of this document are not available from Rapra.

USA

Accession no.778228

Item 167

Adhesives Age

43, No.5, May 2000, p.21/25

HEAT WAVE

Schwartz J

The growth of thermally conductive adhesives in electronic and electrical equipment, and in autoelectrics is discussed, with reference to market studies, industry trends, and product developments. The drive towards miniaturisation with smaller packages offering high performance gives rise to a greater heat generation which adhesives manufacturers are addressing by offering an alternative means of draining excess thermal heat to heat sinks such as metal housing. In addition, adhesives companies are also developing alternative high conductivity fillers in order to improve the flow characteristics of the adhesives which can become difficult to dispense and which can be abrasive and thus limit the useful life of pumping and dispensing equipment.

USA

Accession no.776542

Item 168

Journal of Adhesion Science and Technology

14, No.7, 2000, p.915-24

POLYURETHANE ADHESIVES FOR ELECTRONIC DEVICES

Figovsky O L; Sklyarsky L S; Sklyarsky O N
Polymate Ltd.

Details are given of the properties of new room-temperature-setting polydiene urethane adhesives for electronic packaging. The adhesives were investigated for their mechanical and dielectric properties. Reliability tests on printed circuit boards with the bonded electronic components were carried out under various conditions. 10 refs.

ISRAEL

Accession no.776485

Item 169

Adhesives & Sealants Industry

7, No.3, March 2000, p.52/5

NEW ADHESIVE SYSTEM SAVES INSTALLATION TIME ON SKI RESORT HOME

Masonry contractors working in late-winter/early-spring weather conditions on a ski resort-style private home in Idaho used a new adhesive system from Powers Fasteners. The Acrylic-100 system can be dispensed in below-freezing conditions without sacrificing load capacity or moisture resistance. Acrylic-100 was used to install stone pieces in exterior overhangs and in archways and to attach very large hearth and mantelpiece stones. The new acrylic epoxy resin has a special 7:1 blend of resin to hardener to ensure the proper mixing of components and fast curing at all times and in all kinds of weather.

POWERS FASTENERS INC.

USA

Accession no.770389

Item 170

Adhesives Age

43, No.3, March 2000, p.18-22

FIRED UP

Hung J M

National Starch & Chemical Co.

Research by National Starch & Chemical shows adding a unique catalyst to a reactive hot melt provides an adhesive that develops, on average, more than twice the lap shear strength of conventional reactive hot melts within three hours. This unique catalyst also maintains excellent melt stability and provides a more reliable cure regardless of the humidity in the work environment. Test results are presented. With accelerated curing technology, automotive trim components can be bonded more quickly to meet demanding JIT deadlines.

USA

Accession no.768596

Item 171

Machine Design

72, No.6, 23rd March 2000, p.60-1

AUTOMOTIVE ADHESIVES - FROM DESIGN TO REPAIR

Gascoigne B

Lord Chemical Products Pty.Ltd.

The use is examined of adhesives in automotive applications with reference to original equipment manufacturing use and repair applications. Typical application areas in which adhesives are used in combination with welding are indicated together with future areas of use, and the types of adhesive used are indicated.

AUSTRALIA

Accession no.768061

Item 172

Adhesion '99. Conference Proceedings.

Cambridge, UK, 15th-17th Sept.1999, p.389-94

CONVERSION COATINGS FOR BONDING PLAIN CARBON STEELS

Critchlow G W; Webb P W; Tremlett C J; Brown K
Loughborough,University; British Aerospace Defence Ltd.; Brent International plc
(IOM Communications Ltd.)

A number of chemical conversion coatings were evaluated as prebond surface treatments for plain carbon steels. Modifications to the steel surfaces and effects on the adhesion and durability of joints bonded with an epoxy resin adhesive were investigated, and degreased only, grit blasted and grit blasted/silane primed controls were used

for comparison. Both initial single lap shear (SLS) and residual strength data from SLS joints following immersion in water at 60C were used to discriminate between treatments. The performance of the most effective treatment, an iron phosphate based conversion coating, was ascribed to the formation of a passivating, wettable and very rough substrate.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.765330

Item 173

Adhesion '99. Conference Proceedings.
Cambridge, UK, 15th-17th Sept.1999, p.363-8
**INFLUENCE OF SURFACE AND COHESION
PARAMETERS OF ADHESIVES ON THE METAL
ADHESIVE JOINT STRENGTH (ALPHA-
CYANOACRYLATES)**

Pritykin L M; Lukienko T V; Lyubchenko A N
Pridneprovsk State Academy of Construction &
Architecture
(IOM Communications Ltd.)

Results are presented of a study of the dependence of the adhesive strength of metal joints bonded with polyalkyl cyanoacrylate adhesives on the surface energy and chain flexibility of the adhesives. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; UKRAINE; WESTERN EUROPE

Accession no.765325

Item 174

Adhesion '99. Conference Proceedings.
Cambridge, UK, 15th-17th Sept.1999, p.341-6
**EPOXY MOULDED PRODUCTS: STUDYING
AND INCREASING THE INTERFACIAL
ADHESION**

Harjoprayitno W W; Hadavinia H; Kinloch A J
London,Imperial College of science,technol.& med.
(IOM Communications Ltd.)

A fracture mechanics approach was used to study interfacial failure mechanisms in epoxy resin adhesive joints with the aim of using the measured values to assess the interfacial adhesion of products moulded from epoxy resins. The adhesive interfacial fracture energy under mode I loading of aluminium alloy and copper joints bonded with a silica flour filled epoxy resin adhesive was determined using tapered double cantilever beam specimens. The effects on fracture energy values of different test temperatures, crosshead displacement rates and water and air environments were examined. In all cases the failure locus of the joints was apparently interfacial. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.765321

Item 175

Adhesives Age
43, No.2, Feb.2000, p.32
BONDING AT SEA

Traditional construction methods for high-performance boats use plywood eggcrate and heavy glass epoxy laminate within the hull structure. Thunderbird Products has developed a labour-saving alternative to this type of plywood construction. Several models now use a glass fibre/epoxy structural grid that is bonded to the inside of the hull using Plexus "Fiberglass Fusion" adhesives from ITW Plexus. The advanced methacrylate adhesives were chosen because they eliminate the surface preparation and priming required with PU-based adhesives.

THUNDERBIRD PRODUCTS; ITW PLEXUS
USA

Accession no.764534

Item 176

Adhesive Technology
17, No.1, Feb.2000, p.22
NUCLEAR DEVICE

Carpenter C
UK,Atomic Energy Authority

In UKAEA's nuclear fusion experiments, a new MAST (Mega Amp Spherical Tokamak) vessel is designed to carry a typical plasma current of 1MA, with a maximum rating of 2MA. Epoxy resin mixed with hardener, accelerator and flexibiliser is used in the manufacture of the central solenoid and ten control coils which control the shape and position of the plasma generated within the main vacuum chamber. Both the solenoid and control coils are made by vacuum impregnating copper conductors with the epoxy resin system.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.764486

Item 177

Adhasion Kleben & Dichten
43, No.10, 1999, p.25-31
German
**RAILWAY VEHICLE CONSTRUCTION -
ACOUSTIC AND ECONOMIC ADVANTAGES
THROUGH ADHESIVES**

Iwainsky H
Integral Verkehrstechnik AG

Applications for adhesive technology will grow in scope in railway vehicle construction too. This joint technology counts as an important tool for implementing light-gauge design and good vehicle acoustics. Using the example of an articulated train, this report describes the method for introducing adhesives technology while including relevant mathematical and physical relationships. It reviews the principle of 'forced lagging' in acoustic design, as well

as elasticity and the advantages of adhesives in railway vehicles. 14 refs.

SPEDITION DELLACHER & CO.

AUSTRIA; EUROPE-GENERAL; EUROPEAN UNION;
WESTERN EUROPE

Accession no.763915

Item 178

Adhasion Kleben & Dichten

43, No.10, 1999, p.16/20

German

REACTION ADHESIVES FOR ELECTRONICS

This report surveys the German market for adhesives to be used in the electronics industry. Names and addresses of fourteen manufacturers are given in a table, cross-referenced to curing methods including heat, UV, room temperature, moisture, anaerobic, condensation crosslinking, addition crosslinking, isotropic electrical conductivity, heat conductivity and electrical insulation. It includes areas where such adhesives are useful like chip adhesion, fixing flex or cord and components on printed circuit boards, protective coating for circuit boards, potting and encapsulation such as underfillers. It classifies adhesives as epoxide resins, polyurethanes, acrylates and silicones.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.763913

Item 179

Welwyn Garden City, c.1999, pp.2. 30cms. 6/1/2000

**5420 COMPOSITE BONDING METHACRYLATE
ADHESIVE**

Symonds Cableform Ltd.

A datasheet is presented on 5420, a 1:1 meter mix methacrylate structural adhesive designed for general purpose bonding of a wide variety of materials. The grade forms tough, durable bonds to many substrates including plastics, composites and metal, and is designed for most manufacturing processes where a medium open time and faster fixturing is required. It can be easily dispensed from premeasured cartridges or commercial dispensing equipment using static mixer tubes. Details are given of the adhesive's uncured, curing and cured properties, together with data relating to bond performance, impact strength, and chemical resistance. Packaging, storage and shelf life guidelines are also provided.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.762080

Item 180

Engelwood, N.J., 1998, pp.6, 30 cms. 12/1/00

**PERMABOND ADHESIVES FOR THE MEDICAL
DEVICE INDUSTRY**

Permabond Engineering Adhesives

Permabond medical device adhesives are described in terms of typical applications and properties, and product selection for specific substrate adhesion. The range includes light curing adhesives, cyanoacrylates, epoxy adhesives, and silicone adhesives.

USA

Accession no.762027

Item 181

Polymer Recycling

4, No.2, 1998/9, p.93-100

**ADHESION PROPERTIES OF MATERIALS
BASED ON POST-CONSUMER**

POLYURETHANE WASTE TO METALS

Revyakin O; Zicans J; Kalnins M; Bledzki A K
Riga, Technical University; Kassel, Universitat

The adhesion properties of blends of recycled rigid PU(PUR) and thermoplastic PU(TPU) with different metallic substrates (steel, aluminium, copper) were investigated. The effect of processing conditions (contact time and temp.) on the adhesive strength of the joint was investigated, including possible adhesion processes at the interfaces. The highest values of maximum adhesion strength (Amax) for all systems (contact temp. 190 and 210C) were observed for 10PUR/90TPU adhesive and TPU revealed higher values of Amax. Adhesives based on the PUR20/80TPU and PUR50/50TPU blends revealed higher values of Amax at 210C than at 190C. The exception was adhesion to copper at 210C, where maximum values of peel strength were observed with increasing PUR concentration in the blend. 17 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
LATVIA; WESTERN EUROPE

Accession no.761952

Item 182

Adhesion '99. Conference Proceedings.

Cambridge, UK, 15th-17th Sept.1999, p.129-34

**STIFFNESS AND BUCKLING OF ADHESIVELY
BONDED ROCKET MOTOR TUBES AT HIGH
TEMPERATURE**

Amos R J

British Aerospace Royal Ordnance Rocket Motors
(IOM Communications Ltd.)

Studies of buckling and loss of stiffness at high temperature of adhesively bonded steel strip rocket motor tubes are reported. Methods used to characterise the structural response of such motors by fitting theoretical models to actual test data are discussed. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.761635

Item 183

Adhesion '99. Conference Proceedings.
Cambridge, UK, 15th-17th Sept.1999, p.99-104
**APPLICATION OF DIELECTRIC TECHNIQUES
TO THE CHARACTERISATION OF ADHESIVE
BONDED STRUCTURES**

Pethrick R A; Affrossman S; Comrie R; Li Z C;
Armstrong G; Ivanova K; Halliday S; Hayward D;
Banks W M
Strathclyde, University
(IOM Communications Ltd.)

The use of dielectric measurements for the non-destructive characterisation of aluminium and carbon fibre-reinforced plastics joints bonded with structural adhesives is discussed. Applications of dielectric methods to the detection of water absorption and the study of ageing processes in bonded structures are examined. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.761630

Item 184

Adhesion '99. Conference Proceedings.
Cambridge, UK, 15th-17th Sept.1999, p.49-53
**ADHESIVE BONDING AND DURABILITY OF
PLASMA SPRAYED ADHERENDS**

Dillard J; Capadona J; Zatorski R
Virginia Tech
(IOM Communications Ltd.)

The durability of bonded aluminium specimens plasma sprayed with an epoxy resin adhesive was determined by measuring crack growth of samples at room temperature and of samples immersed in water and boiling water. Failure modes were evaluated visually and by X-ray photoelectron spectroscopy. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA;
WESTERN EUROPE

Accession no.761622

Item 185

West Conshohocken, PA, 1999, pp.7. NALOAN.
**ASTM D 3433-. TEST METHOD FOR FRACTURE
STRENGTH IN CLEAVAGE OF ADHESIVES IN
BONDED METAL JOINTS**

American Society for Testing & Materials
ASTM D 3433-

Version 99. Photocopies and loans of this document are not available from Rapra.

USA

Accession no.760800

Item 186

West Conshohocken, PA, 1999, pp.4. NALOAN.
**ASTM D 1304-. METHODS OF TESTING
ADHESIVES RELATIVE TO THEIR USE AS**

ELECTRICAL INSULATION

American Society for Testing & Materials
ASTM D 1304-

Version 99. Photocopies and loans of this document are not available from Rapra.

USA

Accession no.760784

Item 187

Reinforced Plastics

43, No.6, June 1999, p.40/3

**STRUCTURAL BONDING OF COMPOSITES IN
THE TRANSPORTATION MARKET**

Loven W E
ITW Plexus

It is explained that the high toughness of methacrylate adhesives makes them ideal for joining large parts, such as composite body panels in the transportation industry, and also for bonding metal brackets to composites. This article highlights some of the advantages of methacrylate adhesives over urethane or epoxy systems.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.760047

Item 188

Reinforced Plastics

43, No.6, June 1999, p.34/8

**USING ADHESIVES IN COMPOSITES
ASSEMBLY**

Righettini R; Durso S
Lord Corp.

It is explained in this detailed article that adhesives play a major part in the composites industry, and that they provide assembly solutions for manufacturers in the aerospace, automotive, marine, and other industries. This article examines the practical considerations when introducing and selecting an adhesive for a new composite manufacturing application.

USA

Accession no.760046

Item 189

Eureka

19, No.7, July/Aug.1999, p.20

**TRANSFER ADHESIVES PUT LCD'S IN THE
CLEAR**

Shelley T

This article highlights two adhesive developments from Adhesives Research Europe, both of which have advanced properties for the electronics market. "ARclear" is a clear transfer adhesive especially made for touch screens and other LCD assemblies, and "ARclad" is also designed for touch screens and is electrically conductive. Full details of both are provided.

ADHESIVES RESEARCH EUROPE
EUROPEAN COMMUNITY; EUROPEAN UNION; IRELAND;
UK; WESTERN EUROPE
Accession no.759343

Item 190
Revue Generale des Caoutchoucs et Plastiques
76, No.780, Oct.1999, p.43-5
French
BONDING OF COMPOSITES
Biron M

Following a review of theories of adhesion, the use of adhesives for bonding composites to themselves and to metals is discussed. Surface treatments used to promote the adhesion of composites and factors involved in the selection of adhesives are examined, and examples are presented of the adhesive bonding of composites in the aircraft and automotive industries and in naval construction.

EUROCOPTER FRANCE; MATRA AUTOMOBILE;
DCN
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE
Accession no.758774

Item 191
Joining and Repair of Plastics and Composites.
Conference Proceedings.
London, 16th-17th March 1999, p.193-203
**POLYMER-COATED MATERIAL JOINING
TECHNOLOGY FOR MANUFACTURE AND
REPAIR OF DISSIMILAR MATERIAL
STRUCTURES**
Wise R J; Gosai K
TWI
(Institution of Mechanical Engineers)

The Polymer Coated Material joining technique involves the use of thermoplastics as structural adhesives where the final assembly operation is a polymer weld. In the manufacture of a joint between a thermoplastic component and a dissimilar material component, e.g. metal, the non-thermoplastic component is first coated with the same thermoplastic before both components are welded together. Induction welding is the preferred welding technique, but details are given also of resistive implant welding using thermoplastic CFRP as the implanted heat source and ultrasonic welding which is fast, but needs precautions. The joining of polymers to aluminium alloys is described. Polyetherimide's melting point was so high that the microstructure of the aluminium was changed. PVDF that had been grafted with carboxylic groups to improve adhesion to metals melted at 170C and was a suitable material. It could be coated onto aluminium in N-methylpyrrolidone solution. Aluminium-aluminium components with PVDF interlayer were prepared. 6 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE
Accession no.758457

Item 192
Adhasion Kleben & Dichten
41, No.12, 1997, p.18/23
German
**HOW EFFECTIVE ARE MECHANICAL
PRETREATMENT PROCESSES FOR METALS ?**
Neeb T; Emrich S; Brockmann W
Kaiserslautern,University

Mechanical surface pretreatment is often recommended for metals as a useful processing stage to achieve good adhesion for coatings and adhesives. Recent research work allows us to recognise that such a general recommendation must be modified. The results in this report show that general evidence for improved initial adhesive strength and aging stability for bonded steel joints after mechanical pretreatment must be qualified. The acrylate adhesive used in these tests does not allow any measurable change in combined tension and shear resistance to be recognised by mechanical surface pretreatment. Other acrylate systems have shown similar results. Mechanical pretreatment during the application of polyurethane adhesive shows no positive effects. A combination of this system with abrasives leads to a complete breakdown of bonding within the aging cycle. In contrast, mechanical pretreatment processes applied with mineral and metal abrasives of various geometries lead to considerable improvement in initial adhesive strength and aging stability during the application of epoxide resin adhesives. An exception occurs with glass abrasion which leads to severe delamination in the substrate surface after aging.

CIBA-GEIGY; KOEMMERLING; DEGUSSA
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
SWITZERLAND; WESTERN EUROPE; WORLD
Accession no.758271

Item 193
Journal of Applied Polymer Science
74, No.2, 10th Oct.1999, p.399-406
**NOVEL CONDUCTIVE ADHESIVES FOR
SURFACE MOUNT APPLICATIONS**
Daoqiang Lu; Wong C P
Georgia Tech

An epoxy-based electrically conductive adhesive system containing silver flake fillers was developed which showed improved compatibility with tin/lead components for attaching surface mount components on rigid and flexible printed circuits. When compared with two commercial surface mount conductive adhesives, this one had a more stable joint resistance with tin/lead finished components, much lower moisture absorption, faster cure, comparable bulk resistivity, comparable adhesion strength and a higher glass transition temperature. 8 refs.

USA
Accession no.757321

Item 194

Adhesives Age

42, No.11, Nov.1999, p.12/4

EPOXY ADHESIVES AID NUCLEAR FUSION RESEARCH

Epoxy-based adhesives are being used in the development of a new experimental nuclear fusion device at the UK Atomic Energy Authority. Ciba Specialty Chemicals is supplying epoxy resins, hardener, accelerator and flexibiliser for the assembly of a solenoid and electromagnetic control coils on the Mega Amp Spherical Tokamak experimental fusion vessel.

UK, ATOMIC ENERGY AUTHORITY

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.756752

Item 195

Patent Number: US 5958578 A 19990928

HYBRID LAMINATE HAVING IMPROVED METAL-TO-RESIN ADHESION

Blohowiak K Y; Osborne J H; Krienke K A
Boeing Co.

A surface treatment, especially for titanium and aluminium alloys, forms a sol-gel film covalently bonded on the metal surface to produce strong, durable adhesive bonds between the metal and an organic adhesive without using toxic chemicals and while significantly reducing or eliminating rinse water requirements of traditional anodising or etching processes. An aqueous sol containing a zirconium and an organosilane with an organic acid catalyst and alkoxyzirconium stabiliser is applied to etched or grit blasted substrates by dipping, spraying or drenching, to produce bonds in a single application comparable in strength and performance to standard anodise controls. Parameters affecting performance include the sol composition, the Si/Zr ratio, the ratio of sol ingredients, the concentration of the sol, the carrier solvent, solution age, catalysts, surface pretreatment, application method, curing process, and primer used.

USA

Accession no.755594

Item 196

Adhasion Kleben & Dichten

41, No.11, 1997, p.29-33

German

ELASTIC ADHESION IN VEHICLE CONSTRUCTION (PART II)

Habenicht G; Koch S

Munchen, Technische Universitat; Sika AG

Within the framework of a research project elastic polyurethane adhesives have been subjected to extensive tests. This first part of a four-part contribution (see issue 10/1997) includes examples of current applications as well as deformation mechanisms. It covers investigations into

mechanical stress in vehicles such as buses and cars through measurements obtained during actual running, especially for adhesives bonding to the surface underneath a vehicle's roof. Data is evaluated in relation to areas of stress in a vehicle.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SWITZERLAND; WESTERN EUROPE

Accession no.754467

Item 197

Adhasion Kleben & Dichten

41, No.11, 1997, p.12/5

German

POTTING ELECTRONIC COMPONENTS

Wellmann S

National Starch & Chemical Ltd., Permabond Div.

More than two thirds of all sensors supplied on the market are fitted as motor vehicle and domestic home appliances and have to withstand particularly harsh environmental forces like humidity, high temperatures, radiation and jarring. To ensure their reliability these sensors are encased in adhesives. This article looks at current available materials for this process and the requirements that have to be met. It examines adhesion and sealing of electronic components such as sensors for car temperatures, front crash air bags, gearing, ABS braking and side air bags. It discusses the properties of potting compounds used in these components, such as epoxide resins, silicones and polyurethanes, including their elasticity, fluidity and the chemical advantages of hybrid systems.

EUROPE-GENERAL; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE

Accession no.754463

Item 198

Adhasion Kleben & Dichten

41, Nos.7-8, 1997, p.28-30

German

GLUED CABIN ACCESSORIES IN LIGHTWEIGHT CONSTRUCTION

Here the application of adhesives in manufacturing aircraft cubicles is examined. The firm Dasell Cabin Interior, based in Finkenwerder, Hamburg, is taken as the leading example for these products. The firm was set up in 1993 as a subsidiary of Buderus SELL and Daimler Benz Aerospace to reduce production costs of aircraft toilet cubicles. Processing techniques are reviewed, including glue injection with compressed air glue guns using cold hardening two-component epoxide resin adhesives, as well as semi-automatic processes.

DASELL CABIN INTERIOR; HILGER & KERN

GMBH; BUDERUS SELL; DAIMLER BENZ

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE; WORLD

Accession no.754461

Item 199

Adhasion Kleben & Dichten

41, Nos.7-8, 1997, p.13/6

German

THROUGH ADHESIVES TECHNOLOGY TO HIGHEST PERFORMANCE IN SPORT

Shelford R

CIBA Specialty Chemicals Ltd.

In the field of high performance sports equipment struggling with competition is just as hard as in sport itself. Growing challenges for global competition on the other hand are giving rise to steady further developments in sports equipment which can only be achieved through using adhesives technology. Changes in designs over the last twelve years are examined along with the impact on the use of adhesives arising from new lighter materials in the construction of sports products, including kit light aircraft and bicycles which need to be glued together. Epoxide adhesives are discussed, as well as wood adhesives, the effects of temperature and hardening and the need to bond aluminium and carbon fibres, also the application of adhesives to golf clubs with stainless steel club heads and fibre glass reinforced plastic handles.

LOTUS; GIANT MFG.CO.LTD.

EUROPEAN COMMUNITY; EUROPEAN UNION; SWITZERLAND; TAIWAN; UK; WESTERN EUROPE; WORLD

Accession no.754456

Item 200

Adhesives Age

42, No.10, Oct.1999, p.16-8

DRIVER'S ED

Gascoigne B

Lord Chemical Products (Australia) Pty.Ltd.

The increasing use of adhesives by automotive OEMs and in the aftermarket sector is discussed with reference to current trends and applications. Adhesives are claimed to offer the automotive engineer the potential for diversity of design that cannot be achieved by any other means, and in addition there are significant technical and commercial benefits to their use in modern production environments. The use in particular, of structural adhesives is examined, and current and future areas of use are indicated.

AUSTRALIA

Accession no.753338

Item 201

Revista de Plasticos Modernos

78, No.517, July 1999, p.55-8

Spanish

ELASTIC ADHESIVES IN THE SPORTS SECTOR

Sastre A

Sika SA

The mechanical properties and adhesion characteristics of elastic one-component PU adhesives are examined, and

applications in the bonding of plastics and composites in the manufacture of sports equipment are reviewed.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.752767

Item 202

Automotive Engineer

24, No.10, Nov.1999, p.73-4

STICKERS FOR EFFICIENCY

Russell E

Information is presented in some detail on the increasing use of adhesives in automotive assembly as commercial pressures grow. New technology is making possible projects such as 3M's development of a fully bonded car and aluminium components bonded together with adhesives in the Audi A8. Others mentioned as using more adhesives include the Lotus Elise chassis' use of structural adhesives, and use of Loctite 341 two-part acrylic structural adhesive on the aluminium bonnet of Aston Martin's Vantage.

3M UNITED KINGDOM PLC; LOCTITE (UK) LTD. EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.751961

Item 203

Adhasion Kleben & Dichten

41, No.6, 1997, p.30-4

German

ADHESION IN RAIL VEHICLE CONSTRUCTION

Dengler M; Lemm K

Institut fuer Schienenfahrzeuge

In the European and especially the German rail vehicle industry work is being done at present on new vehicles and systems which also in future should ensure the competitiveness of the products on offer in the international market. An important contribution to this is made by adhesives technology which is also opening up new fields of application in the area. Possible adhesives applications to rail vehicle external components are discussed along with bonding and jointing capabilities, also fittings, floors, roofing, adhesive quality, technical demands, metal to non-metal construction and polyurethane adhesives.

EUROPE-GENERAL; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.751050

Item 204

Adhasion Kleben & Dichten

41, No.4, 1997, p.38-40

German

NEW PRE-TREATMENT PROCEDURES FOR METAL ADHESIVES

Schubert P; Berger S; Gehrke J; Kleinert H; Kaiser W-D
Dresden, Technische Universität; Dresden, Institut für
Korrosionsschutz

In the motor vehicle repair sector most jobs can only be done with cold-curing two-component adhesives. Pre-treatment procedures used hitherto with organic solvents have an unpredictable environmental impact. Here environmentally friendly alternatives are examined with the help of experiments. These include bonding strengths for aluminium with its pre-treatment primers based on phenol resin methacrylate dispersions with hydrosilicone additives as well as for steel. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.751039

Item 205

Medical Device Technology

10, No.8, Oct.1999, p.29/33

ADHESIVES: A SELECTION GUIDE

Turner M

Medical Engineering Technologies Ltd.

The use of three types of adhesive for medical device assembly is analysed. The advantages and disadvantages, typical applications and key features are defined for cyanoacrylate, epoxies and UV and light cured adhesives. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.750619

Item 206

155th ACS Rubber Division Meeting, Spring 1999.

Conference Preprints.

Chicago, Ill., 13th-16th April 1999, Paper 50, pp.41

ADHESION SYSTEMS FOR BELTS AND HOSE

Hewitt N L

PPG Industries Inc.

(ACS, Rubber Div.)

Studies were made of the influence of silica fillers, silane coupling agents, curing systems, resorcinol and phenolic resins and compounding and vulcanisation conditions on the adhesion of rubber belt and hose compounds to fabrics and cords. Results for the adhesion of polychloroprene, EPDM, chlorobutyl rubber and nitrile rubber indicate that increased silica content, resorcinol and phenolic resins, zinc oxide and magnesium oxide are the major sources of improved bonding. 3 refs.

USA

Accession no.749863

Item 207

Adhesion Kleben & Dichten

41, No.10, 1997, p.35-8

German

**ELASTIC BONDING IN VEHICLE
CONSTRUCTION (PART I)**

Habenicht G; Koch S

München, Technische Universität; Sika AG

With the purpose of giving the technical designer accessible, reproducible data on adhesives well before beginning product development, elastic bonding materials have been subjected to application oriented experimentation in the field of cohesion within the framework of a research project. The results will appear in a four-part contribution. Part I appears here and describes current areas of application in vehicle construction, while discussing deformation mechanisms of polyurethane bonding. Part II of this four-part contribution deals with investigation into strain on elastic bonding through measurements in practice and is published in issue 11 (1997).

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
SWITZERLAND; WESTERN EUROPE

Accession no.744819

Item 208

Morrisville, N.C., c.1999, pp.9. 28cms. 5/8/99

**VFM PROCESSING : RAPID CURE
TECHNIQUES FOR THE ELECTRONIC
PACKAGING INDUSTRY**

Lambda Technologies Inc.

The principles of variable frequency microwave (VFM) energy are outlined and a description given of applications for the processing technique in the electronic packaging industry. The procedure can be used for rapid and selective curing of encapsulants, adhesives and polyimides, as well as for bonding electronic components onto flexible or rigid circuit boards without compromising functionality. Advantages of the method include heating uniformity and elimination of arcing problems. Typical uses include curing of underfill, glob-top liquid encapsulant, and cavity dam and fill encapsulant. VFM can also be used to accelerate the post-mould curing necessary to enhance the glass transition of polymer compounds and is useful in structural bonding applications and in the curing of polyimide coatings on silicon wafers. Brief details are given of the MicroCure 5100 and MicroCure 2100 VFM systems available from Lambda Technologies.

USA

Accession no.743210

Item 209

International Journal of Adhesion & Adhesives

19, Nos.2-3, 1999, p.193-8

**CLP: NEW, EFFECTIVE, ECOLOGICAL
SURFACE PRETREATMENT FOR HIGHLY
DURABLE ADHESIVELY BONDED METAL
JOINTS**

Broad R; French J; Sauer J

Ciba Specialty Chemicals Inc.

In order to achieve durable adhesively bonded metal joints, besides choosing a suitable adhesive, surface pretreatment is essential in many cases. This for example, is especially valid for aluminium, aluminium alloys and also for stainless steel. The newly developed and patented, Ciba laser pretreatment (CLP) uniquely combines processing benefits with the opportunity for cost savings and excellent performance of adhesively bonded metal joints. CLP also stands out with its environmentally friendly way of operation. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
SWITZERLAND; UK; WESTERN EUROPE

Accession no.742006

Item 210

Adhesives & Sealants Industry

6, No.5, June/July 1999, p.56

**GRAPHITE EPOXY CONTRIBUTES TO
SUCCESS OF THRUST SUPERSONIC CAR**

The Thrust SuperSonic Car is the first vehicle to break the sound barrier on land, and materials supplied by Cytec Fiberite contributed to its success. The company's facility in Wrexham, UK, supplied the carbon and glass fibre composite materials, which are concentrated around the forward position of the engine nacelles, nose cone, air-inlet structures and cockpit canopy. In addition, the company's structural adhesive film, supplied from its Havre de Grace, Md., facility, is used on the engine nacelles and cockpit canopy. In most instances, the materials were chosen for their light weight, stiffness and strength. The forward engine nacelles are made from Cytec Fiberite's high-performance epoxy-graphite composite material, which consists of graphite fabric prepreg surrounding a honeycomb core bonded with the company's FM-87-1 HT epoxy film adhesive. Details are given.

CYTEC ENGINEERED MATERIALS INC.; CYTEC
INDUSTRIES INC.; FIBERITE INC.
USA

Accession no.741819

Item 211

Kettering, c.1999, pp.6. 30cms. 5/7/99

**WORLD'S LEADING MANUFACTURERS OF
STRUCTURAL METHACRYLATE ADHESIVES
FROM ITW PLEXUS**

ITW Plexus

Information is presented on the Plexus range of high performance structural adhesives for bonding engineering plastics, composites and metals. The recyclable adhesives are tough and flexible, offering excellent resistance to oil and chemicals as well as high peel and impact strength. They can be used over a wide temperature range (-40C to +120C) and require little or no surface preparation. Examples are given of their use in specific applications, including the bonding of GRP body panels and bumper assemblies in vehicles and the bonding of acrylic to

aluminium in signmaking. Plexus adhesives have been approved by Lloyd's Register for marine bonding applications and comply to a range of London Underground fire testing requirements. A guide is provided to fourteen Plexus grades and the substrates for which they are recommended.

POLYMER ENGINEERING; SUNSEEKER
INTERNATIONAL; ROCKDOOR LTD.; FORGE
PLASTICS; ROVER; COLVIC CRAFT PLC;
LLOYD S REGISTER

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.740410

Item 212

Kettering, c.1999, pp.2. 30cms. 5/7/99

**PLEXUS NEW LOW ODOUR MA900
ADHESIVES**

ITW Plexus

ITW Plexus has added low odour adhesives to its range of Plexus methacrylate structural adhesives for bonding engineered thermoplastics, composites, and metals. The 900 Series comprises three grades with up to 90% less odour and less than 1% VOC. The adhesives are recyclable and are suitable for use in the automotive, marine and construction industries. The characteristics of each grade are described and data supplied on chemical resistance and physical, mechanical and shear properties. Indications are given of materials for which the grade is recommended.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.740409

Item 213

Kettering, c.1999, pp.2. 30cms. 5/7/99

**USING ITW PLEXUS IN COMPOSITE
FABRICATION**

ITW Plexus

Information is presented on the use of Plexus high performance structural adhesives in composite fabrication. The thixotropic formulations have been successfully used in bonding decorative laminate panelling to aluminium on rolling stock and in the bonding of RTM and GRP double-skinned body panels to a steel modular frame for the Nissan Sani 4x4WD. Other applications highlighted include Kevlar bonding in hull construction, bonding of GRP door skins to thermoplastic frames, and bonding of GRP automotive bumper and headlight assemblies. A listing is provided of composites with which the adhesives can be successfully used, while a table presents data on eight Plexus grades.

GEC ALSTHOM; ERF TRUCKS; NISSAN MOTOR CO.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.740408

Item 214

Synthetic Metals

104, No.2, 8th July 1999, p.107-11

POLYPYRROLE-BASED CONDUCTING HOT MELT ADHESIVES FOR EMI SHIELDING APPLICATIONS

Pomposo J A; Rodriguez J; Grande H
CIDETEC

Intrinsically-conducting hot melt adhesives(ICHMAs) were developed, based on polypyrrole blends, for use in electronic and telecommunication applications requiring shielding against electromagnetic interference(EMI). These advanced materials were formulated to exhibit significant EMI shielding effectiveness while retaining the superior properties of conventional hot melt adhesives. The conductivity properties, adhesion characteristics and both near- and far-field EMI shielding effectiveness behaviour of these ICHMAs at room temp. were investigated as a function of polypyrrole content. The environmental stability of the conductivity was also investigated. The potential use of these new materials in current and future electronic applications is considered. 24 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN;
WESTERN EUROPE

Accession no.739051

Item 215

Journal of Applied Polymer Science

73, No.5, 1st Aug.1999, p.695-705

ADHESIVE AND THERMAL CHARACTERISTICS OF MALEIMIDE-FUNCTIONAL NOVOLAC RESINS

Gouri C; Reghunadhan Nair C P; Ramaswamy R
Vikram Sarabhai Space Centre

An addition-curable, maleimide-functional novolac phenolic resin was evaluated for its adhesive properties, such as lap shear strength and T-peel strength, using aluminium adherends, when thermally self-cured and co-cured with epoxy resins. The adhesive properties of the self-cured resin, although inferior at ambient temp., improved at high temp. and were found to depend on the cure conditions. When co-cured with epoxy resin, the adhesive properties improved significantly and showed a marked dependence on the nature of the epoxy resin used, on the stoichiometry of the reactants, on the concentration of imide groups in the phenolic resin and on the extent of polymerisation of the maleimide groups. 17 refs.

INDIA

Accession no.738365

Item 216

Adhesives & Sealants Industry

6, No.4, May 1999, p.38-40

VALUE-ADDED ADHESIVES FOR AUTOMOTIVE INTERIOR TRIM

Ilkka J R

Reichhold Inc.

Adhesive bonding of trim components within automotive interiors is a rapidly evolving market. Providing value-added products and services allow Reichhold's Tier One customers to meet or exceed OEM expectations. A case study involving a PU adhesive for headliner manufacturing is presented to show how value analysis is used to identify opportunities for value-added products. USA

Accession no.736129

Item 217

Materiaux & Techniques

86, Nos.9/10, Sept./Oct.1998, p.59-61

TESTING AND ANALYSIS OF RUBBER-TO-METAL BONDED PARTS

Jacks J

Acadia Polymers Inc.

The shortcomings of techniques such as Fourier transform IR spectroscopy and energy dispersive X-ray analysis in the study of failure in rubber-to-metal bonded parts are discussed. Results are presented of a study in which SEM and X-ray photoelectron spectroscopy were used in the failure analysis of a rubber-to-steel bonded component which had failed after exposure to hydrocarbon oil at 150C. The results suggested premature curing of the adhesive as the most likely cause of failure.

USA

Accession no.732508

Item 218

Adhesives & Sealants Industry

6, No.3, April 1999, p.41

MEDICAL DEVICE ASSEMBLY

A wide variety of disposable and reusable medical devices are manufactured using adhesives to permanently bond similar and dissimilar substrates. Assembling a syringe involves bonding a body assembly made of some type of plastic, typically PP, to a stainless steel cannula or needle. Light-cure acrylic adhesives are frequently used for this application.

USA

Accession no.731128

Item 219

Adhesives & Sealants Industry

6, No.3, April 1999, p.38-9

PSAS INCREASE SAFETY AND EFFECTIVENESS OF AIRBAG INFLATORS

Adhesives Research and Seal Methods have jointly developed a new generation of pressure sensitive adhesive-component solutions for automotive airbag inflator applications. In general, adhesives for airbag

inflators serve to position and set the airbag in place, hermetically seal the propellant and attach the propellant cover. It was determined that silicones, with their thermal stability, low outgassing and capacity for a tight hermetic seal, were most promising.

ADHESIVES RESEARCH INC.; SEAL METHODS
INC.
USA

Accession no.731126

Item 220

West Drayton, 1995, pp.2. 12 ins. 30/4/99.

RALLIPRUF 234

Astor-Stag Ltd.

Ralliprufe 234 is a heavy-duty, cold-applied bitumen roofing felt adhesive. It has a high initial grab and is said to provide excellent adhesion to most common substrates. It can be used to bond roofing felt to timber, metal, concrete, asphalt and felt roofs, for sealing laps on roofing felt, and as a dressing compound for chippings on flat roofs. Methods of application and surface preparation are described.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.729237

Item 221

West Drayton, 1998, pp.2. 12 ins. 30/4/99.

PURFLEX. PRODUCT DATA

Astor Ltd.

Details are given of Purflex, a single component polyurethane based sealer and adhesive, which has been formulated to meet a variety of needs within the vehicle construction and repair areas. The material cures by reaction with atmospheric moisture to form a high performance permanently flexible sealant and adhesive, with skin and cure times dependent upon humidity and temperature. Properties are listed.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.729223

Item 222

West Drayton, 1998, pp.2. 12 ins. 30/4/99.

PURFLEX MARINE. PRODUCT DATA

Astor Ltd.

Bonding and sealing applications are indicated for Purflex Marine, a one-component polyurethane sealant and adhesive which has been developed specifically for marine applications. It is formulated to overcome the pinholing effects associated with deck caulking at high temperatures, and can be used on most marine substrates such as aluminium, plywood, glass, GRP, and wood.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.729222

Item 223

Composite Structures

44, No.1, Jan.1999, p.17-29

COMPOSITE REPAIRS TO CRACKS IN THICK METALLIC COMPONENTS

Jones R; Chiu W K

Monash,University

Experimental and numerical studies into the repair of cracks in thick structural aircraft components are reported. The design guidelines on repairs to thick sections are summarised. A range of problems were considered, including semi-elliptical surface flaws, interacting surface flaws, cracked fastener holes and cracked lugs. It was shown that externally bonded composite repairs can be successfully used to extend the fatigue life of thick structural components. A successful design requires a full 3-dimensional stress analysis and consideration particularly of interlaminar failure in the repair. 17 refs.

AUSTRALIA

Accession no.726584

Item 224

Coatings World

4, No.3, April 1999, p.50/3

AUTOMOTIVE ADHESIVES & SEALANTS MARKET

Esposito C C

Demand for adhesives used in the motor vehicle industry is forecast to increase 1.9%/year to reach more than 670,000 metric tons in 2002. High performance products that can replace mechanical fasteners and attach plastics, rubber and aluminium components are becoming more prevalent in new cars. 3M has launched a new structural product, a two-part acrylic adhesive, which replaces vibrational welding. Canning claims there is a growing trend to move away from conventional gasketing to liquid gasket materials.

WORLD

Accession no.724495

Item 225

Patent Number: US 5859181 A 19990112

SILOXANE POLYIMIDE AND HEAT-RESISTANT ADHESIVE CONTAINING THE SAME

Zhao D; Sukuyama H; Katono T; Chiang L-C; Lin J-T
Nippon Mektron Ltd.

A solvent-soluble siloxane polyimide comprising a copolymer obtained by reaction of a diamine compound mixture comprising a diaminopolysiloxane and an alicyclic diamine with an aromatic tetracarboxylic acid anhydride, followed by polyimidisation reaction of the resulting polyamic acid forms a heat-resistant adhesive by adding an epoxy resin, a diamine-based curing agent and an organic solvent. The formed adhesives show a distinguished heat-resistant adhesiveness when the

resulting siloxane polyimide, soluble in ordinary organic solvents, is used as a main component of the adhesive for bonding between a base material and a copper foil of a flexible printed substrate. By further addition of a fluorinated resin to the adhesive, the adhesiveness can be improved.

JAPAN

Accession no.724461

Item 226

Patent Number: US 5861119 A 19990119

METHOD OF FORMING STRUCTURAL PANEL ASSEMBLIES

Merser N K

Illinois Tool Works Inc.

The method of forming rigid panel assemblies of this invention eliminates the requirement for mechanical fasteners and may be used to bond wall boards to studs, floor joists to wood flooring such as plywood or OSB boards and trusses to ceiling panels. The method includes applying a thin bead of a thoroughly mixed two-component liquid polyurethane foamable resin adhesive on the surface where the components are to be joined. The foamable resin is then allowed to cream and rise before bonding. Where the bead is applied to the side faces of the support members, the support members are preferably turned to orient the foam beads over the fibrous panel, which is preferably supported on a flat horizontal support surface. Finally, the beads are compressed against the fibrous panel, wetting the panel with liquid foam resin before the foam is gelled, permanently bonding the support members to the panel and forming the structural panel assembly. Where an enclosed panel assembly, such as a closed wall is desired, the structural members are attached to a first panel, orienting the support members for application of the polyurethane foam bead described.

USA

Accession no.723552

Item 227

Adhasion Kleben & Dichten

38, No.9, 1994, p.12-4

German

SANDWICH ELEMENTS: ADHESIVES MAKE THE BOND

Endlich W

IBC Ing.& Beratungsburo fuer Kleb-und Dichttechnik

The manufacture of sandwich elements using one-component polyurethane adhesives is described. They are intended for such applications as caravan construction, dividing walls for buildings or ships' interiors and insulation purposes. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.721516

Item 228

Philadelphia, PA, 1997, pp.+2.

MIL-A-87135. ADHESIVES, NON CONDUCTIVE, FOR ELECTRONICS APPLICATION

US Military

MIL-A-87135

Version Notice 2. Similar to SAE AMS 3703. Photocopies and loans of this document are not available from Rapra. USA

Accession no.720770

Item 229

Philadelphia, PA, 1997, pp.+2.

MIL-A-83376. ADHESIVE BONDED METAL FACED SANDWICH STRUCTURES, ACCEPTANCE CRITERIA

US Military

MIL-A-83376

Version A Notice 2. Photocopies and loans of this document are not available from Rapra.

USA

Accession no.720769

Item 230

Philadelphia, PA, 1997, pp.16.

MIL-A-48611. ADHESIVE SYSTEM, EPOXY-ELASTOMERIC, FOR GLASS TO METAL

US Military

MIL-A-48611

Version A Notice 2. Photocopies and loans of this document are not available from Rapra.

USA

Accession no.720768

Item 231

4th European Conference on Composites: Testing and Standardisation. Conference proceedings.

Lisbon, Portugal, 31st Aug.-2nd Sept.1998, p.359-61. 627-951

MECHANICAL CHARACTERISATION FROM ROOM CONDITIONS TO HIGH HUMIDITY LEVELS AND HIGH-LOW TEMPERATURES OF COMMERCIAL EPOXY BASED ADHESIVES USED IN THE CIVIL CONSTRUCTION INDUSTRY FOR STRUCTURAL REHABILITATION

Neves R; Esteves J L; Marques A T

INEGI; CEMACOM; Porto,Universidade

(Institute of Materials)

Fibre reinforced plastic (FRP) wraps have been established as an effective method of rehabilitation and strengthening of concrete structures. Together with the deterioration of the concrete, the performance of the adhesive layer at working conditions is of extreme

importance. The results are presented of an experimental study on the tensile properties of different commercial available epoxy based structural adhesives at standard test conditions (23 deg.C and 50% relative humidity) and with a special proposed tensile test with different temperature-humidity levels simulating the ambient equilibrium of working conditions for the structural rehabilitation of concrete structures. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; WESTERN EUROPE

Accession no.719028

Item 232

Handbook of Polymer Composites for Engineers.
Cambridge, Woodhead Publishing Ltd., 1994, p.201-41. 627

BONDED AND MECHANICAL FASTENED JOINTS

Matthews F L

Edited by: Hollaway L
(BPF)

Joints may be needed due to limitations in material size, for convenience in manufacturing or transportation, to provide access and to link sub-assemblies. Wherever possible, it is recommended that a designer should avoid using joints. The main methods used for metals, adhesive bonding and mechanical fastening are also applicable to composites. Welding may be a possibility for thermoplastic composites, but the method is not well developed for load-carrying joints. The issues to be considered when selecting a method are described. It is always possible to design a bonded joint that is stronger than the composite being joined. It is very difficult to design a mechanically fastened joint to have a strength greater than 50% of that of the composite; to obtain acceptable efficiency, local reinforcement may therefore be needed. Galvanic corrosion of certain metals (aluminium and alloys, low alloy steels, martensitic steels, copper, brass, cadmium (plating)) can occur when using CFRP. The use of a sealant or corrosion protection barrier is recommended at the interfacing surface of composite-to-metal joints, or when using fasteners, in these materials. Aspects covered include joint types, mechanism of load transfer, bonded joints, mechanically fastened joints and bolted-bonded joints. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.718987

Item 233

Adhesives Age

42, No.2, Feb.1999, p.31-2

CONCRETE EVIDENCE

The Hardshell Concrete Restoration System and epoxy adhesive allowed contractors to install composite jackets on eight columns per day to restore 80 concrete bridge

overpass columns. The Hardshell system consists of composite fibreglass/vinyl ester shells manufactured by Hardcore using the Seemann Composites Resin Infusion Molding Process. Ciba's TDT 177-149 epoxy adhesive was applied to the groove of the H-connector along the length of the shell edge.

CIBA SPECIALTY CHEMICALS

USA

Accession no.718506

Item 234

Revista de Plasticos Modernos

75, No.501, March 1998, p.288-91

Spanish

ELASTIC ADHESIVES IN THE FABRICATION AND USE OF COMPOSITE MATERIALS

Sastre A

Sika SA

An examination is made of the mechanical properties of low modulus one-component PU elastomer adhesives and their use in bonding composites to themselves and to other substrates. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

Accession no.715857

Item 235

Machine Design

71, No.3, 11th Feb.1999, p.74/8

STRICT STANDARDS FOR CLEAN ADHESIVES

Epple T

Avery Dennison Corp.

Adhesives, particularly pressure-sensitive adhesives and labels, have been widely used in the hard disc drive industry for many years. In hard disc drives, PSAs bond together materials ranging from stainless steel to foam gaskets. Other applications are ID labels and tape seals which keep out contamination and act as tamper-evident seals for proof of warranty.

USA

Accession no.714528

Item 236

International Polymer Science and Technology

25, No.6, 1998, p.46-8

FEATURES OF THE ADHESIVE BONDING OF RUBBERS CONTAINING AN EFFECTIVE VULCANISING SYSTEM TO METALS

Reznichenko S V; Rybalov B A

Moscow, Scientific Research Institute of Elastomeric Materials & Products

Details are given of the formation of adhesive bonds of vulcanised products using vulcanising systems with metals. The investigation was carried out on two rubber mixes based on butadiene-acrylonitrile rubber. The

strength of adhesive bonds was assessed. 2 refs. Translated from *Kauch.i.Rezina*, 1, 1998, p.36

RUSSIA

Accession no.714289

Item 237

Advanced Packaging

8, No.1, Jan.1999, p.38/42

ELECTRICALLY CONDUCTIVE ADHESIVES AS AN ALTERNATIVE TO SOLDER

Small D J; Eisenach B; Lewis A; Babiarz A
Loctite Corp.; Asymtek Inc.

Electrically conductive adhesives are playing an increasingly prominent role in the design and production of electronic packages. These adhesives offer a lead-free alternative to solder and may be applied to a variety of substrates using a relatively low temperature bonding process. Typical electrically conductive adhesives are made up of an isolating epoxy resin and some quantity of conductive metal particles. Isotropic and anisotropic conductive polymers, and adhesive application considerations are discussed.

USA

Accession no.713195

Item 238

Adhesives Age

41, No.12, Dec.1998, p.22/33

FLEXIBLE METHOD FOR APPLYING ADHESIVES TO PRINTED CIRCUIT BOARDS

Lathrop R R
Heraeus Inc.

Adhesive is applied for holding SMT components to the bottom side of mixed technology boards during the wave solder operation. Printable adhesives have been developed to yield a wide range of deposit heights from a single stencil thickness. Laser triangulation measurement methods have been used to quantify the printability of these new adhesives. 4 refs.

USA

Accession no.711274

Item 239

Structural Adhesives in Engineering V. Conference proceedings.

Bristol, 1st-3rd April 1998, p.268-73. 6A1

STRUCTURAL ADHESIVELY-BONDED JOINTS IN ENGINEERING - STRUCTURAL DESIGN

van Straalen I J J; Wardenier J; Vogelsang L B; Soetens F
TNO Building & Construction Research;
Delft, University of Technology; Eindhoven, University of Technology
(Institute of Materials)

The methodology of the process of drafting design rules for adhesively-bonded joints used for structural

applications is described. One of the main aspects of this process is the structural analysis of an adhesively-bonded joint. Such analysis should deal with issues related to the estimation of a failure criterion, the choice of a model to calculate the stress state and the determination of material properties. These issues are described and placed within the context of reliability methods. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION;
NETHERLANDS; WESTERN EUROPE

Accession no.705814

Item 240

Structural Adhesives in Engineering V. Conference proceedings.

Bristol, 1st-3rd April 1998, p.256-61. 6A1

SELECTION OF ADHESIVES AND PRETREATMENTS FOR STRUCTURAL BONDING OF ALUMINIUM IN SHIPS

Weitzenbock J R; Echtermeyer A T; Hayman B
Det Norske Veritas
(Institute of Materials)

An experimental programme to screen adhesives and pretreatments suitable for structural bonding of aluminium in a marine environment is reported. Specimens are made from extruded 6xxx series aluminium. Three different surface pretreatments are used in the test programme. The adhesives used are acrylic, silicone and two-component epoxy adhesives. All the adhesives cure at room temperature. The main objective is to assess the performance of the selected adhesive systems in a marine environment. The Boeing wedge test is selected due to its high sensitivity to environmental effects and differences in surface preparation. The specimens are immersed in seawater at different temperatures. Crack growth and failure modes are compared and evaluated for different adhesives, pretreatments and water temperatures. 7 refs.

NORWAY; SCANDINAVIA; WESTERN EUROPE

Accession no.705812

Item 241

Structural Adhesives in Engineering V. Conference proceedings.

Bristol, 1st-3rd April 1998, p.47-52. 6A1

FATIGUE OF ADHESIVELY-BONDED ALUMINIUM IN A MARINE ENVIRONMENT

Smitnieks S; Spinks G M
Wollongong, University
(Institute of Materials)

The use of adhesives for both non-structural and semi-structural purposes is increasing at a rapid rate. This increase in use is directly related to the realisation of the many advantages adhesives have over more conventional means of joining materials. However, there are a number of industries which are sceptical of the long term performance of adhesives and hence their use has been

kept to a minimum. One of these industries is the aluminium shipbuilding industry in which the long-term durability of adhesives is at question due to the hostile environments encountered in this field. A means of testing the fatigue strength of adhesively bonded joints while simultaneously applying a hostile environment is developed. The development of pretreatment systems which assist in providing satisfactory fatigue performance is examined. 4 refs.

AUSTRALIA

Accession no.705780

Item 242

International Journal of Adhesion & Adhesives

18, No.5, 1998, p.365-9

DURABILITY OF STEEL/POLYMER ADHESION IN AN AQUEOUS ENVIRONMENT

Bistac S; Vallat M F; Schultz J

Institut de Chimie des Surfaces et Interfaces

The durability of steel/polymer/steel assemblies in various liquids, including water, salt, acid and basic solutions, was studied. Two steel substrates were compared, one without any surface treatment and the other with a phosphatising surface treatment. The polymer was EVA grafted with maleic anhydride. The wedge test was used in order to quantify the steel/polymer adherence before and during ageing. The results showed that a rapid delamination was observed for the non-treated steel/EVA assemblies in all the liquids studied. A cathodic delamination process was proposed to explain the delamination mechanism. Good ageing resistance was observed for the phosphatised steel/EVA assemblies, not only due to the corrosion resistance of the steel substrate but also due to the insensitivity of the interfacial steel/polymer bonds to the liquids studied. 20 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE

Accession no.704888

Item 243

International Journal of Adhesion & Adhesives

18, No.5, 1998, p.351-8

STRENGTH OF ADHESIVE JOINTS FROM FUNCTIONALIZED POLYETHYLENE AND METALS

Pesetskii S S; Jurkowski B; Kuzavkov A I

Belarus Academy of Sciences; Poznan, University of Technology

LDPE and functionalised LDPE (LDPE-g-itaconic acid(IA)) adhesive interaction with copper, steel and aluminium was studied. Differences in LDPE and LDPE-g-IA adhesive capability were found to be determined by oxidative transformations occurring at the metal-adhesive interface at the stage of the contact formation, rather than by their physical structure. Carboxylic group grafting to LDPE macromolecules resulted in acceleration of the

macromolecules' oxidation in the adhesive boundary layers on copper and steel and also in its inhibition. When adhesive joints from functionalised PE and metal were broken, a predominantly cohesive character was observed along the adhesive boundary layer. A change in the adhesive strength of LDPE-g-IA under varying technological conditions was caused mainly by the altered concentration of low molecular substances in the contact zone. 36 refs.

BELARUS; BELORUSSIA; EASTERN EUROPE; POLAND

Accession no.704886

Item 244

International Composites Expo '98. Conference proceedings.

Nashville, Tn., 19th-21st Jan.1998, Session 3-F. 627

STRUCTURAL BONDING OF DISSIMILAR MATERIALS WITH METHACRYLATE ADHESIVE

Leeser D; Lambert K

ITW Plexus

(SPI, Composites Institute)

When faced with joining two materials, a designer has numerous choices. With the intensive research into adhesion and the resulting new adhesive technologies currently available, adhesive bonding is a popular option. When selecting a structural adhesive, the choices begin to narrow. Some of the leading candidates for structural applications are epoxy, urethane and methacrylate chemistries. To decide on the best adhesive, the substrates to be bonded, the mechanical property requirements and the ability of the adhesive to meet the physical requirements must be evaluated. An in-depth discussion of methacrylate adhesives, their properties and the wide range of substrates they are able to bond is presented.

USA

Accession no.702096

Item 245

Materials Challenge - Diversification and the Future.

Volume 40: Book 1. Symposium proceedings.

Anaheim, Ca., 8th-11th May 1995, p.154-67. 627

COMPOSITE STRUCTURES REPAIR DEVELOPMENT FOR THE F/A-18E/F AIRCRAFT

Rubin A M; Perl D R

McDonnell Douglas Corp.; US, Naval Aviation Depot (SAMPE)

Conceptual repair development for new and modified structures on the F/A-18E/F aircraft, utilising advanced composite materials, is described. Typical in-service damage such as maintenance/ground induced damage, crash damage, etc., experienced on the F/A-18C/D aircraft is considered for the development of repairs to the new type of structure (cocured and hat stiffened skin) used on the F/A-18E/F. Difficult semi-flush bonded repairs with

limited or no backside access are emphasised. Development efforts include identification and qualification of new ambient temperature storable repair materials and development of appropriate non-destructive testing/inspection (NDT/I) techniques. 8 refs.

USA

Accession no.698114

Item 246

Materials Challenge - Diversification and the Future. Volume 40: Book 1. Symposium proceedings. Anaheim, Ca., 8th-11th May 1995, p.112-21. 627

ELECTRON AND X-RAY CURING FOR COMPOSITE REPAIR

Saunders C B; Lopata V J; Kremers W
AECL Whiteshell Laboratories
(SAMPE)

Electron curing of adhesives can be used for repairing damaged composite products. The advantages of using electron curing rather than thermal curing include a faster cure cycle and higher temperature resistant bonds, cured at ambient temperatures. Research to develop electron curing for repair applications, including formulating adhesives, is rapidly progressing at several industrial and government laboratories, including AECL Research. The required penetration of energy and cure speed are two key design parameters when considering electron curing of adhesives. The penetration limit for 10-MeV electrons is about 2 cm in graphite composite. If a penetration greater than 2 cm is needed, then the X-rays generated from 10 MeV electrons penetrate about 10 cm in a composite. For most electron curable adhesives, the needed cure dose is about 50 kGy. AECL Research's activities in the area of composite repair using electron curing technology are described, including process descriptions and preliminary economics.

CANADA

Accession no.698110

Item 247

RadTech '98. Conference proceedings. Chicago, Il., 19th-22nd April 1998, p.133-9. 895

ADVANCES IN UV TECHNOLOGY FOR MEDICAL DEVICE FABRICATION

Beasley J
Lesco Inc.
(RadTech International)

No-one wants to change the manufacturing process for medical disposables unless they are compelled and the improvements have to be tangible. If not, there is scant reason for the engineer to change the process, especially if it involves any changes in the design protocols that lead to increased documentation to satisfy the FDA. The sophistication of the use of UV technology for these applications has also advanced. In some cases the applications have pushed the manufacturers of the resins

and equipment to further extend the limits of the capabilities of the technology. This is usually a function of a faster cure requirement that needs both ends of the process to react faster than before. A number of different applications and the improvements that the advances in UV technology have contributed are described. 2 refs.

USA

Accession no.696902

Item 248

Journal of Applied Polymer Science

70, No.2, 10th Oct.1998, p.383-7

INVESTIGATION ON THE MODIFICATION OF POLYPROPYLENE BY GRAFTING OF MALEIC ANHYDRIDE BASED ON THE ASPECT OF ADHESION

Chi-Wen Lin; Wei-Lun Lee
Taiwan,National Yunlin University of Science & Technology

Isotactic PP was modified by chemical grafting of maleic anhydride in the molten state. The degree of grafting, ranging from 0.078-0.368%, was determined by a titration method. Isotactic PP modified by chemical grafting of maleic anhydride was used as an adhesive in bonding cold-rolled steel shafts for the correlation of its bondability. It was found that the maximum adhesive strength of 159 kg/sq cm was obtained from a degree of grafting of 0.217%. A higher degree of grafting was detrimental not only to the initial adhesive strength, but also to the durability aged in a wet environment. ESCA was used to analyse the failure loci because the joint was separated by shearing. 10 refs.

TAIWAN

Accession no.696871

Item 249

International Journal of Adhesion & Adhesives

18, No.4, 1998, p.237-46

MEASUREMENT OF ADHESIVE JOINT FRACTURE PROPERTIES AS A FUNCTION OF ENVIRONMENTAL DEGRADATION

Wylde J W; Spelt J K
Toronto,University

The degradation of the fracture strength of two epoxy resin adhesives (Cybond 1126 and Cybond 4523GB) was measured using a new approach to accelerated ageing. 'Open-faced' specimens were prepared by applying adhesive to aluminium plates and, after curing, exposing them to a range of temps. and humidities. At various times, the adhesive layer was bonded to a second aluminium adherend to form a double-cantilever-beam fracture specimen. The critical strain energy release rate was then measured at several mode ratios by ensuring that the crack followed a path in the 'primary' adhesive. This approach yielded fracture data which unambiguously corresponded to a particular, uniform state of degradation. Furthermore,

the rate of water absorption was markedly accelerated. The 'wet' state fracture data illustrated the combined effects of water plasticisation and degradation, while the 'dry' state data showed only the irreversible effects of degradation. 21 refs.

CYTEC
CANADA

Accession no.695534

Item 250

Euradh '96. Adhesion '96. Volume Two. Conference proceedings.

Cambridge, 3rd-6th Sept.1996, p.577-82. 9(12)4

**MIXED-MODE RESISTANCE CURVE
BEHAVIOUR OF STRUCTURAL ADHESIVELY-
BONDED JOINTS**

Shah J H; Lang L; Liechti K M

Austin, University of Texas; ADT Engineering
(Institute of Materials; Societe Francaise du Vide;
Dechema Institut)

Efforts are being made to reduce the fuel consumption of cars. One potential method is to make use of fibre-reinforced polymer matrix composites as primary structures. It is anticipated that many of the joints in the structure will be adhesive in nature. Adhesive bonding offers advantages in several areas when compared to mechanical fastening. These include reduced part count, economies in manufacturing and assembly, and reductions in stress concentrations and corrosion. At the same time, experience with primary structural adhesively-bonded joints in the automotive industry is relatively limited. Potential failure mechanisms include adhesive and cohesive crack growth along the composite/adhesive interface or within either component. Crack growth can be dynamic due to impact. Lower loading rates can give rise to quasi-static growth with or without time dependent effects, depending on glass transition temperature and moisture sensitivity of the adherends and the adhesive layers. Cracks in adhesively bonded joints are rarely subjected to purely uniaxial loading such as tension or shear. It is more usual for fracture in adhesively bonded joints to be mixed-mode in nature, involving various combinations of tensile (mode I) and shear (mode II) effects depending on the particular joint assembly, loading and crack length. Emphasis is placed on the resistance to quasistatic mixed-mode crack growth under short term, monotonic loading. 4 refs.

USA

Accession no.694806

Item 251

Euradh '96. Adhesion '96. Volume One. Conference proceedings.

Cambridge, 3rd-6th Sept.1996, p.361-4. 9(12)4

**DEVELOPMENT OF NOVEL ADHESIVES FOR
BONDING ENGINEERING THERMOPLASTICS**

Moss N S; Wilson R G

Ciba Polymers

(Institute of Materials; Societe Francaise du Vide;
Dechema Institut)

Eight engineering thermoplastics are selected by manufacturing partners in a project as of potential future interest in the design and construction of electrical/electronic devices. In order to facilitate easy assembly of these plastics in complex designs, and in combination with metals and other materials, bonding is the preferred technique. The primary objective for Ciba Polymers was to identify suitable adhesives for bonding each type of plastic, with minimal surface pre-treatment. The bonded joints were required to give good thermal and environmental stability. The adhesives were required to be fast curing, and preferably one component, although two-component products which could be dispensed in a mixed form by suitable equipment, would also be acceptable. Standard commercial adhesives were initially evaluated on all the substrates, in order to establish the most suitable chemistries for bonding each substrate. The adhesive types evaluated were: one component bisphenol A or bisphenol A/F-based epoxy adhesives, one-component adhesives based on multifunctional epoxy resins, two-component amine cured epoxy adhesives, two-component PUs based on MDI, two component flexible PUs based on aliphatic isocyanate pre-polymer, two-component methacrylate adhesives, UV curing acrylic adhesives and UV activated or UV curable epoxy adhesives.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.694771

Item 252

Adhesives Age

41, No.6, June 1998, p.52-3

ADHESIVES IN ENGINEERING

Bowtell M

This article picks highlights from papers presented at the structural adhesives conference held by the Institute of Materials in London, England, in April 1998. It mentions topics such as metal structural adhesives, aerospace applications, durability and fatigue, the evaluation of structural adhesive joints in real conditions, environmental degradation, pretreatments, and marine applications.

3M; CIBA; INSTITUTE OF MATERIALS; BRITISH
AEROSPACE; WOLLONGONG, UNIVERSITY;
STOKE GOLDING APPLIED RESEARCH
AUSTRALIA; EUROPEAN COMMUNITY; EUROPEAN UNION;
UK; WESTERN EUROPE

Accession no.691666

Item 253

Plastiques Modernes et Elastomeres

49, No.4, May 1997, p.55-6

French

NORDSON FRANCE BACKS ASSEMBLY

Gailliez E

An examination is made of the activities of Nordson France in the assembly of automotive, electrical and electronic components by hot melt and cold bonding techniques. Turnover and employment figures are presented for Nordson France and the Nordson Group as a whole.

NORDSON FRANCE; NORDSON CORP.; WALCOM
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
NETHERLANDS; USA; WESTERN EUROPE

Accession no.691307

Item 254

Advanced Packaging

7, No.4, May 1998, p.52-3

ADHESIVE/EPOXY

In semiconductor packaging, adhesives and epoxies are used extensively to encapsulate integrated circuits for preservation of signal integrity and for protection from environmental contamination. Other uses include bonding the die to the substrate, underfill in flip chip or direct chip attach operations, various sealing operations involving electrical insulation, and as conductive or thermal insulating materials themselves. Recent product developments made available by a number of US manufacturers are reviewed.

USA

Accession no.689852

Item 255

Adhesive Technology

15, No.1, March 1998, p.2

ADHESION IS THE KEY TO TOLL BOOTH DESIGN

ACX Industries specialises in design solutions using composite materials. The company designs and manufactures in a range of specialist areas that focus on light weight, ease of production and installation, special design and high-performance requirements. Adhesive technology came to the rescue for a project to design a motorway toll booth in France. The company has achieved a European first in the field of civil engineering. It designed, constructed and then installed a roofing system for motorway toll booths on the A29 between Le Havre and Yvelot made entirely from glass reinforced polyester. The roof design measures 60 m long x 20 m wide and is entirely self-supporting. During the early stages of the design process, it became clear that the mechanical requirements for the points where the roofing was to be anchored to the main structure were very complex. The

search for a cost-effective and high-performance solution led to a combination of metal copings, bolts and Araldite 2022, a two-component toughened methacrylate adhesive system from Ciba Speciality Chemicals. Brief details are noted.

ACX INDUSTRIES

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.689828

Item 256

Antec '98. Volume II. Conference proceedings.

Atlanta, Ga., 26th-30th April 1998, p.1386-91. 012

QUANTIFYING POLYMER ADHESIVE INTERFACIAL PERFORMANCE IN ELECTRONIC PACKAGES

Brillhart M V; Dai X; Ho P S

Hewlett-Packard Co.; Texas, University
(SPE)

The performance requirements of future electronic packages create the need to transition from traditional wire bond connections to advanced technologies such as flip chip and direct chip attach. Adhesion between silicon chips and substrates (ceramic or polymer laminates) is crucial for the reliability of these chip attach methods. Novel reproducible experimental techniques based on fracture mechanics for quantitatively evaluating the interfacial performance of silicon/epoxy adhesion and polymer substrate/epoxy junctions in flip chip systems are presented. These techniques can be employed to rapidly evaluate new materials and examine process modification impact on adhesive performance in a wide range of environments. 4 refs.

USA

Accession no.688617

Item 257

Machine Design

70, No.11, 18th June 1998, p.70/6

ADHESIVES GET IN THE GROOVE

Raymond M K

Design engineers faced with the challenge of bonding advanced composites are reported to be relying on the latest in developments in adhesives technology. Although retaining the same adhesive for specific design applications seems like the right thing to do, advances in technology such as electronics miniaturisation and new composite materials are continuing to drive adhesive development. When choosing a fastening method, engineers should consider the advantages of adhesive bonding, along with the basic principles of adhesion of the products. One of the advantages of using adhesives is they bond the entire surface area of a joint, which minimises stress and adds strength. Because mechanical loads are distributed over a larger area, stress does not concentrate in the same way as it does for rivets, bolts or welds. Bond strength is also not

sacrificed for thinner, lighter materials. A review of developments in this area is presented.

USA

Accession no.688183

Item 258

International Journal of Adhesion & Adhesives

18, No.3, 1998, p.159-65

SELECTION OF AN ADHESIVE FOR THE CONSTRUCTION OF A GLASS-ADHESIVE T-BEAM

Pye A; Ledbetter S
Bath,University

Details are given of the feasibility of producing composite glass-adhesive beams for the construction of wall, roof and canopy structures. The selection of suitable adhesives are discussed and the performance of five glass T-beams manufactured with a modified epoxy resin are reported. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.684929

Item 259

Antec '98. Volume I. Conference proceedings.

Atlanta, Ga., 26th-30th April 1998, p.1095-9. 012

HEAT-ACTIVATED JOINING TECHNOLOGY FOR COMPOSITE TO ALLOY PIPING SYSTEMS

Stubblefield; Uang C; Pang S-S
US,Southern University; Wichita,State University; Louisiana,State University
(SPE)

A new process for joining composite to alloy piping systems, the heat-activated joining technique, is developed. The strength of the heat coupling joint in bending, tension and hydrostatic testing is comparable to the butt weld method for composite/composite systems. A finite element model is also developed to predict the temperature distribution of the heat coupling joint during the curing process. The predicted value differs less than 10% from that of the experimental data. 5 refs.

USA

Accession no.684681

Item 260

Antec '98. Volume I. Conference proceedings.

Atlanta, Ga., 26th-30th April 1998, p.1084-8. 012

ACCELERATED CURING OF EPOXY PASTE ADHESIVES FOR REPAIR OF COMPOSITES USING INDUCTION HEATING

McKnight S H; Fink B K; Wells S; Yarlagadda S; Gillespie J W
US,Army Research Laboratory; Delaware,University
(SPE)

A methodology for accelerated curing of commercially available room temperature curing paste adhesives is outlined. Cure kinetics of the adhesive are studied by thermochemical analysis and degree of cure is related to processing parameters and cure cycles. Increasing the cure temperature to 100 deg.C reduces the cure time from 16 hrs to approximately 15 minutes for 98% cure. Induction heating techniques are used to demonstrate rapid heating of adhesive at the bond line for lap shear specimens. 7 refs.

USA

Accession no.684679

Item 261

Composite Interfaces

5, No.4, 1998, p.345-61

EFFECT OF SURFACE TREATMENT FOR STEEL ADHERENDS ON STATIC AND FATIGUE CRACK GROWTH OF EPOXY ADHESIVES

Naito K; Hirakata H; Fujii T
Doshisha,University

The fracture toughness of unmodified, glass bead-reinforced and crosslinked nitrile rubber-modified epoxy adhesives under mode I loading was not improved by acid surface treatment of steel adherends, as cohesive failure always occurred for all adhesives with or without acid surface treatment. On the other hand, the fatigue crack growth resistance greatly increased due to acid surface treatment of steel adherends. In particular, the threshold dramatically increased. The crack grew cohesively at all stages of crack velocity for double cantilever beam specimens treated with acids, while it grew at the interface between the adherend and the adhesive layer for the specimens whose polished surface of adherends was only decreased with solvent. An optical microscope observation revealed that adherend surfaces treated with acids were rougher than ones without acid treatment, although X-ray photoelectron spectroscopy examination for the surfaces did not show a significant difference in their chemical elements among the specimens with and without acid treatment. 18 refs.

JAPAN

Accession no.684599

Item 262

Patent Number: US 5672229 A 19970930

SOLVENT-FREE TWO-COMPONENT POLYURETHANE REACTIVE ADHESIVES AND THEIR USE FOR PRODUCING SANDWICH-TYPE INTERIOR PANNELLING FOR VEHICLES

Koenig E; Gronemeier U F; Wegener D
Bayer AG

This invention relates to solvent-free two-component polyurethane reactive adhesives comprising: (A) a polyisocyanate component based on diphenylmethane diisocyanates; (B) a water-containing polyol component having a maximum of three OH groups, a water content

of 0.25 to 2.0 wt.%, and an OH value of 300 to 600, and optionally (C) auxiliary substances and additives, wherein component (A) and component (B) are present in proportionate amounts such that the isocyanate index is 120 to 250. These adhesives are used for producing sandwich-type interior panelling for vehicles.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.684234

Item 263

Adhesives Age

41, No.5, May 1998, p.30

EPOXY ADHESIVE AND CARTRIDGE DISPENSER FACILITATE SMC PANEL REPAIR

The use of Araldite epoxy resin adhesives for the repair of SMC body panels on trucks is discussed. Triad Freightliner uses the high performance epoxy adhesives which produce long-lasting, sag-resistant joints that can withstand exposure to environmental extremes and vibration. The adhesives are supplied in 200 ml cartridges that provide for precise mixing and low waste applications, using Liquid Control's Supermix II cartridge dispensing systems.

TRIAD FREIGHTLINER; CIBA SPECIALTY CHEMICALS, PERFORMANCE POLYMERS
USA

Accession no.682505

Item 264

Adhesives & Sealants Industry

5, No.4, May 1998, p.42

ADHESIVES PLAY ROLE IN HEAVY-DUTY TRUCK MANUFACTURE

The construction of the Kenworth T2000 Class 8 truck is described, with particular respect to its use of Pliogrip adhesive systems from Ashland Chemical. Many of the truck's composite parts are bonded using the two-component urethane adhesive system. Advantages are described of the use of Pliogrip adhesives, and in addition, details are given of the manufacture of some of the Kenworth T2000 truck's engine and vehicle castings made using Ashland Chemical's Foundry Products Division's Isocure binder system, a phenolic urethane cold-box binder.

ASHLAND CHEMICAL CO., SPECIALTY POLYM. & ADHES. DIV.
USA

Accession no.681158

Item 265

Adhesives & Sealants Industry

5, No.4, May 1998, p.28-9

STOCK CAR BUILT AT SAE CONGRESS

The use of Loctite adhesives and sealants in automotive applications was demonstrated at the SAE 1998

International Congress in Detroit. During the first three days of the congress, a Canadian stock car crew assembled their Chevrolet Monte Carlo at Loctite's booth and exhibited the completed car on the final day. Loctite also introduced Nuva-Sil 5092 at the exhibition, an advanced electrical/electronic potting and sealing compound for connectors and sensors. The company's activities in the automotive field are discussed, and a list of their 'firsts' for the automotive industry is included.

LOCTITE CORP.

USA

Accession no.681154

Item 266

Machine Design

70, No.4, 10th March 1998, p.214/6

FLEXIBLE METHOD FOR APPLYING ADHESIVES TO PCBS

Lathrop R; Miric A
SMT

The use of adhesive printing as a method for securing components to printed circuit boards is discussed, in terms of its advantages over traditional dispensing methods. In particular emphasis is given to the design of the stencil. A new printing process is described which is based on the surface tension between the glue and the stencil opening, which allows some glue to remain in the stencil apertures after separating from the PCB.

USA

Accession no.675268

Item 267

Journal of Adhesion Science and Technology

12, No.2, 1998, p.123-33

EFFECT OF ANTI-CORROSIVE POLYMER COATING ON BOND STRENGTH BETWEEN EPOXY RESIN AND STEEL PLATE

Lu Y; Cao Q; Li F; Xue G; Jiang B
Nanjing, University

Steel plates (type A3) are subjected to different surface pretreatments: coating with PPS or polyphenylene sulphide ketone (PPSK) water-based suspension, or phosphating, and then bonded to epoxy resin. The shear strengths of as-prepared joints and of joints aged in boiling water or in simulated seawater are determined. The surfaces of the steel plates are examined using Fourier transform infrared diffuse reflectance spectroscopy (FTIR-DRS) and scanning electron microscopy (SEM). Joint samples used shortly after preparation show cohesive failure in the adhesive, but those that aged for some time show interfacial failure. It is found that the mean shear strength (MSS) of joints made from steel specimens treated by phosphating is lower than those from steel specimens treated by the polymeric coating. 11 refs.

CHINA

Accession no.674832

Item 268

Adhesives & Sealants Industry

5, No.1, Feb.1998, p.96

MOISTURE-RESISTANT CHIP ADHESIVES FOR PLASTIC BGA PACKAGES

Properties and characteristics are described for a new high flow liquid encapsulant and two new die-attach adhesives from Johnson Matthey Electronics, which have been designed to protect integrated circuits in cavity-style plastic ball grid array (BGA) packages from moisture and mechanical damage. The new materials are called JM8850 (encapsulant), JM7100 and JM7200. The die-attach products are claimed to be among the first adhesives to meet JEDEC Level 3 preconditioning standards for thermally enhanced BGAs.

JOHNSON MATTHEY ELECTRONICS
USA

Accession no.671860

Item 269

Patent Number: US 5654382 A 19970805

EPOXY RESIN HIGH IN ORTHO BISPHENOL F

Dubois R A; Ohnishi H; Malzman A J
Dow Chemical Co.

An epoxy resin prepared from a component comprising a bisphenol F having high ortho isomer content is claimed. Ortho isomer content is defined as: $(A+2B)/2$, A = content of ortho-para isomer of a bisphenol F; B = content of ortho-ortho isomer of a bisphenol F. The epoxy resin formed has lower viscosity (e.g. melt viscosity, solution viscosity) and good physical properties (e.g. flexibility), and is suitable for various applications such as coating materials, electrical laminates, adhesives, moulding products, encapsulation materials etc.

USA

Accession no.671198

Item 270

Plast' 21

No.55, Oct.1996, p.117-20

Spanish

THERMOPLASTIC POLYESTER FOAMS FOR THE MANUFACTURE OF SANDWICH PANELS

Madariaga L; Gomez J L; Mediavilla A
Gaiker

Results are presented of experiments undertaken by Gaiker in the manufacture of sandwich panels containing foam cores based on PETP recycled by a solid state polyaddition process developed by M & G Ricerche. Panels were produced with glass fibre-reinforced unsaturated polyester and epoxy resin skins, and all-thermoplastic panels with PE, PP, PS and glass fibre-reinforced PETP skins were also produced. EVA hot melt adhesives and thermoset adhesives were evaluated in bonding glass fibre-reinforced PETP skins to the foam

cores. Data are presented for the mechanical properties of the structures studied.

M & G RICERCHE SPA; BERSTORFF
H.,MASCHINENFABRIK GMBH; SISTEMA
COMPOSITI SPA; NAPLES,UNIVERSITY;
INSTITUT FUER CHEMIEFASERN
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
ITALY; SPAIN; WESTERN EUROPE

Accession no.670869

Item 271

International Composites Expo '97. Conference proceedings.

Nashville, Tn., 27th-29th Jan.1997, Paper 88. 627

METHOD FOR FABRICATION OF STRUCTURAL ADHESIVE JOINTS

Reichard R P

Structural Composites Inc.
(SPI,Composites Institute)

Adhesive structural joints are typically formed by applying a bead of adhesive to one surface of a structural part or panel and placing a second structural part or panel onto the adhesive bead, compressing it to cover most or all of the joint surface. The joint is then secured (usually with mechanical fasteners or by clamping) until the adhesive has cured. The patent pending method presented is a combination of adhesive/adhesive tape technology, involving the use of adhesive tape to temporarily secure and to create a channel between the structural parts to be joined. Liquid adhesive is then pumped into the channel to form a permanent bond. This allows multi-part structures to be 'tacked' together quickly, checked for accuracy, and then permanently bonded later by injecting the adhesive. The technology eliminates adhesive drips and spills, provides a more consistent bond line, and uses less adhesive. It also significantly reduces the amount of labour involved in bonding the parts. 3 refs.

USA

Accession no.665465

Item 272

Composites & Adhesives Newsletter

14, No.1, Oct.-Dec.1997, p.12-3

SWEDEN: STRENGTHENING CONCRETE BEAMS WITH COMPOSITES, ADHESIVES

This article highlights research from Lulea University in Sweden, on the repair of concrete beams (such as in bridges) using adhesive bonding technology. Originally the studies concentrated on bonding steel plate, but now fibre-reinforced composites are the centre of interest, with efforts being directed at strengthening both shear and bending loads. Full details are given.

LULEA,UNIVERSITY; SWEDISH INSTITUTE OF
COMPOSITES; NIL MALMGREN AB;
SPANNARMERING AB
SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.665195

Item 273

Revue Generale des Caoutchoucs et Plastiques

No.749, April 1996, p.56-9

French

EPOXY RESINS: PRODUCTS FOR NICHE MARKETS

Gossot J

An examination is made of the synthesis, curing, properties and applications of epoxy resins. Applications in coatings, adhesives, composites and the electrical and electronic sector are discussed. Leading manufacturers of epoxy resins are listed, and statistics are presented for the European Union and world markets for such resins.

CIBA-GEIGY AG; SHELL CHEMICAL CO.;

HOECHST AG; DOW CHEMICAL CO.

EU; EUROPEAN COMMUNITY; EUROPEAN UNION;

GERMANY; SWITZERLAND; USA; WESTERN EUROPE;

WESTERN EUROPE-GENERAL; WORLD

Accession no.663529

Item 274

152nd ACS Rubber Division Meeting, Fall 1997.

Conference Preprints.

Cleveland, Oh., 21st-24th Oct.1997, Paper 21, pp.33. 012

WIRE ADHESION: A REVIEW OF PRESENT DAY TECHNOLOGY AND A LOOK TO THE FUTURE

Hoff C M

Cytec Industries Inc.

(ACS,Rubber Div.)

One-component melamine resins capable of forming a network without the need for a co-reactant such as resorcinol were evaluated as adhesion promoters in the bonding of rubbers to steel cords, and their performance was compared to that of some classical two-component methylene donor-methylene acceptor systems. The one-component systems gave good original and aged adhesion, equivalent tensile and dynamic mechanical properties and superior cut growth resistance. 8 refs.

USA

Accession no.658275

Item 275

Journal of Polymer Science : Polymer Chemistry

Edition

35, No.14, Oct.1997, p.2943-54

DESIGN AND CHARACTERISATION OF THERMOSETTING POLYIMIDE STRUCTURAL ADHESIVE AND COMPOSITE MATRIX SYSTEMS

Tan B; Vasudevan V; Lee Y J; Gardner S; Davis R M;

Bullions T; Loos A C; Parvatareddy H; Dillard D A;

McGrath J E; Cella J

Blacksburg,State University; GE Corporate R & D

Fully cyclised, organo soluble, phenylethynyl-terminated, etherimide oligomers were prepared by the reaction of

2,2'-bis(4-(3,4-dicarboxyphenoxy)phenyl)-propane dianhydride (bisphenol A dianhydride, BPADA) with a stoichiometric excess of either para, meta, or isomeric mixtures of phenylene diamine and phenylethylphthalic anhydride (4-PEPA) endcapper. High para-containing oligomers produced semicrystalline powders, but all meta isomer was completely amorphous. Resin infusion moulding was conducted, which permitted low-void, graphite fabric composite panels to be prepared. 12 refs.

USA

Accession no.657601

Item 276

International Journal of Adhesion & Adhesives

17, No.3, 1997, p.223-7

ADHESIVES MADE FROM INTERPENETRATING POLYMER NETWORKS FOR BONDING RUSTED IRON WITHOUT PRETREATMENT

Sie H-Q; Guo J-S

Huazhong,University of Science & Technology

Adhesives made from two types of room-temperature-cured interpenetrating polymer network (IPN) based on castor oil PU/vinyl or acrylic polymer and PU/(unsaturated polyester and vinyl or acrylic polymer) are studied. The effects of NCO/OH molar ratio, PU content, type of vinyl or acrylic monomer and weight ratio of monomer/polyester on the adhesive properties of IPNs between rusted iron plates are investigated. The results show that, for the first type of IPN, the lap-shear strength of the IPN between rusted iron plates exhibits a maximum value at 60-80% PU content and increases with NCO/OH molar ratio. For different monomers, the lap-shear strength of the IPNs decreases with decreasing glass transition temperature of the vinyl or acrylic polymer. For the second type of IPN, acrylonitrile seems to be the best monomer. Optimum lap-shear strength occurs at about 88 wt.% acrylonitrile content in the acrylonitrile/(polyester + monomer). 8 refs.

CHINA

Accession no.654436

Item 277

International Journal of Adhesion & Adhesives

17, No.3, 1997, p.203-6

ACTIVATING ADHEREND SURFACES BY APPLYING ARC-DISCHARGE TREATMENT

Kleinart H; Grosse S; Schultrich B; Siemroth P

Dresden,Technische Universitat; Fraunhofer-Institut fuer Werkstoffphysik und Schichttechnologie

The demands on adhesive joints and for their long-term durability, especially under extreme environmental conditions, are steadily increasing. Most of the currently used chemical methods of adherend surface pretreatment that lead to high values of strength and ageing resistance are no longer acceptable for environmental reasons. As a possible alternative method, a pretreatment utilising the

physical energy of arc discharges is studied. It was found that the strength and ageing resistance of adhesive joints prepared with the one-step arcing procedure is of the same order as, or even better than, those with the best chemical pretreatment technologies currently available. The research is continuing, with the focus on obtaining higher working speeds, optimising the procedure and its application to different materials. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.654433

Item 278

Macromolecular Symposia

Vol.118, June 1997, p.11-22

LCP POLYESTERS VERSUS THERMOSETTING POLYESTERS: A PARADIGM FOR RESEARCH IN THE 21ST CENTURY

Economy J; Frich D; Schneggenburger L A
Illinois University at Urbana-Champaign

A review is presented of the authors' research on liquid crystalline saturated copolyesters and thermosetting aromatic copolyesters, with particular reference to adhesion properties, and in the development of adhesives and multichip modules based on these thermosetting copolyesters. 15 refs.

USA

Accession no.649958

Item 279

Journal of Adhesion Science and Technology

11, No.7, 1997, p.941-56

ANALYSIS OF AIRCRAFT ADHESIVE JOINTS UNDER COMBINED THERMAL AND MECHANICAL CYCLIC LOADING

Abdo Z; Aglan H
Tuskegee, University

The effect of thermal ageing on the static and fatigue behaviour of adhesively bonded aircraft joints was investigated. Single lap joints of aluminium and structural adhesive prepreg were used. The ageing cycle consisted of high and low temperatures at different levels of humidity. 41 refs.

USA

Accession no.649526

Item 280

International Journal of Adhesion & Adhesives

17, No.2, May 1997, p.143-50

FURTHER STUDIES INTO THE EFFECTIVENESS OF CARBON DIOXIDE-LASER TREATMENT OF METALS FOR ADHESIVE BONDING

Critchlow G W; Cottam C A; Brewis D M; Emmony D C
Loughborough, University

The effect of carbon dioxide-laser treatment on the wettability of mild steel was studied and data were obtained

on the initial joint strengths and durability of joints formed between a single-part epoxide and both mild steel and aluminium. A large increase in stressed durability performance was observed with the laser-treated aluminium compared with degreased-only controls. The laser treatment was shown efficiently to remove the organic contamination from the metallic substrates. Auger analysis showed that the laser interacted more with the mild steel than the aluminium adherends, to produce a relatively thick surface oxide. The changes to the mild steel surface introduced by the carbon dioxide-laser treatment facilitated an approximately 50% increase in initial joint strengths. The absolute strength retention in unstressed durability trials was greater than the laser-treated adherends than with degreased-only controls. 8 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.641445

Item 281

International Journal of Adhesion & Adhesives

17, No.2, May 1997, p.89-105

LONG-TERM DURABILITY IN WATER OF ALUMINIUM ALLOY ADHESIVE JOINTS BONDED WITH EPOXY ADHESIVES

Armstrong K B

Some of the previous papers on the topic of durability of adhesive bonds to aluminium alloy are reviewed, covering the period 1977 to 1991. The current test programme using the wedge test to ASTM D-3762 is then described, together with the adhesives and surface preparations chosen. Several cold-setting epoxy resins and a smaller number of hot-setting epoxy resin film adhesives were tested. All the testing was done on 2024-T3 clad aluminium alloy, specimens being immersed in distilled water at room temp. and readings of crack length being taken at intervals for 5.5 years, after which the specimens were subjected to further testing and surface analysis of failures by SEM. Four surface preparation methods were compared. 38 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.641439

Item 282

TAPPI 1996 Hot Melt Symposium. Conference proceedings.

Phoenix, Az., 16th-19th June 1996, p.227-32. 6A1

HIGH PERFORMANCE HOT MELTS FOR THE BONDING OF POLAR AND NON-POLAR SUBSTRATES

Heucher R; Butterbach R
Henkel Corp.; Henkel KGaA
(TAPPI)

Information is presented in some detail on the development of new high performance hot melt adhesives

which are said to be capable of bonding to polar and non-polar substrates, with or without pretreatment. The new adhesives are reported to be based on two types:- i) polyamide resins and blends, and ii) PP resins and blends. Their development for cable applications is used as an example of why new technology in this sector requires new adhesive products. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.638964

Item 283

Journal of Adhesion

62, Nos.1-4, 1997, p.281-315

ENVIRONMENTAL AGEING OF ADHESIVELY-BONDED JOINTS. I. DIELECTRIC STUDIES

Joshi S B; Pethrick R A; Gilmore R; Yates L W; Hayward D

Strathclyde,University; British Aerospace

High and low frequency dielectric measurements are reported on epoxy resin and phenolic resin-adhesively bonded aluminium structures aged by exposure to moisture. Changes observed were interpreted in terms of initially water diffusing into the adhesive layer. Correlations are given between the time domain data and the increased dielectric permittivity resulting from ingress of moisture into the adhesive bond. 31 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.638489

Item 284

Materials & Manufacturing Processes

12, No.2, 1997, p.175-86

CHARACTERISTICS AND VARIABLES OF SPOT WELDING AND WELDBONDING BIMATERIALS

Darwish S M; Soliman M S; Al-Faheed A M
King Saud University

Spot welding and weldbonding have been adopted for manufacturing bimaterials. Spot welding parameters namely, welding current, electrode force and welding cycles have been optimised and reported for manufacturing bimaterial (brass/steel) damping sheets. Tensile strength, fatigue strength, microhardness measurements and microstructure examination have been performed and are reported. This work demonstrates much improvement in fatigue strength associated with weldbonding, when compared with spot welded bimaterials. A one-part structural toughened epoxy resin Permabond ESP 728 filled with aluminium powder which improved thermal conductivity, reduced shrinkage and lowered the thermal expansion coefficient was used throughout this work. 15 refs.

SAUDI ARABIA

Accession no.637403

Item 285

Antec 97. Volume I. Conference proceedings.

Toronto, 27th April-2nd May 1997, p.1171-5. 012

STEEL GIRDER REHABILITATION THROUGH ADHESIVE BONDING OF COMPOSITE MATERIALS

Gilespe J W; Mertz D R; Edberg W M; Ammar N
Delaware,University
(SPE)

A complete system approach to the rehabilitation of degraded steel bridge girders through the adhesive bonding of composite materials is presented and demonstrated. The flexural characteristics of steel bridge girders are shown to be improved through testing of various reinforcement schemes on scale steel sections and testing of a selected scheme on corroded bridge girders taken out of service. Applications to bridge girders with corrosion damage and fatigue crack damage are demonstrated. 3 refs.

USA

Accession no.636814

Item 286

Adhesives & Sealants Industry

4, No.3, April 1997, p.40-2

BETTER PROCESS CONTROL WITH UV SPOT CURING OF MEDICAL DISPOSABLES

Beasley J
Lesco Inc.

The use of UV curing equipment and adhesives for assembling medical devices has continued to increase over the years. It is rare for devices not to incorporate some UV bonding in their design. If not, chances are good that some competitive devices do use UV to speed up manufacturing and provide an even tougher structural bond than previously successful systems, such as solvent-bonding or two-component epoxies. Recent applications incorporating innovative uses of UV technology in the medical device market are examined. The advances in equipment performance and capabilities making this technology a better process tool and more self monitoring during operation to provide a more controlled manufacturing process are described. 3 refs.

USA

Accession no.635759

Item 287

Adhesives & Sealants Industry

4, No.3, April 1997, p.37

UV CURABLES PROVIDE CONTROL IN MEDICAL DEVICE ASSEMBLY

Vassallo C A
Electro-Lite Corp.

The joining of medical disposables - such as hypodermic needle bonding, PVC-tubing connections and plastic-

housing assembly - has commonly been accomplished with epoxies, PUs or solvent-based adhesives. While these systems are both effective and economical, two-component systems may be slow to cure. In addition, regulatory agencies have discovered that potential solvent residues may be harmful in the medical environment where these parts are used. The use of UV light-curable adhesives, which are inherently free of solvents and cure on demand in seconds, offers an attractive alternative.

USA

Accession no.635757

Item 288

Reprint (Glass Age, 1994, Sept.), pp.1. 30ins. 28/2/97

PORTAL STICKS WITH CASCO

Details are given of the use of Casco Nobel adhesives by panel manufacturer Portal Products. Portal manufactures a range of infill panels for doors, conservatories and office partitions and uses a solvent-free, two-component polyurethane adhesive from Casco to bond the sandwich elements of PVC-U, aluminium, marine plywood, and styrofoam insulation. The spray application technique employed by Portal is described and brief information on the company and its product range is presented.

CASCO NOBEL INDUSTRIAL ADHESIVES;
PORTAL PRODUCTS

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.634391

Item 289

European Adhesives & Sealants

14, No.1, March 1997, p.23

**ICARUS AND ALLSORTS - THE THOMAS
HAWKSLEY MEMORIAL LECTURE**

Ford P

A report is presented on the 84th Thomas Hawksley Memorial Lecture by Professor A.J. Kinloch, which discussed the developments in adhesive technology for engineering applications. In particular, the use of adhesive bonding methods for aircraft is examined from an historical perspective.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.633641

Item 290

Angewandte Makromolekulare Chemie

Vol.245, March 1997, p.37-47

**EFFECT OF METAL IONS ON SELF-
REINFORCEMENT OF METAL/ADHESIVE
INTERPHASE BY GAMMA-
AMINOPROPYLTRIETHOXY-SILANE**

Gu X; Xue G

Nanjing, University

Copper/epoxy resin joints were pretreated with a 1 wt% solution of gamma-aminopropyltriethoxysilane in ethanol. Self-reinforcement of the metal/adhesive interphase was observed when the joints were exposed in 3% aqueous sodium chloride solutions for 160 days. This was attributed to coordination between the copper ions and the amino groups of the silane and diaminodiphenylmethane curing agent. This was confirmed by a model experiment in which aluminium substrates were pretreated with silane solutions containing moderate amounts of copper salts and bonded with an epoxy resin adhesive. Examination of the mechanically failed surfaces by X-ray photoelectron spectroscopy showed that the as-prepared joints had a strengthened interphase and that failure propagated predominantly through the adhesive. 16 refs.

CHINA

Accession no.632380

Item 291

Chemical Week

159, No.12, 26th March 1997, p.28/30

ELECTRONICS SURGE ON

Kemezis P

Sales of adhesives to the electronics sector continue to grow at a healthy rate as the underlying demand for semiconductors remains buoyant and conductive adhesives replace solder in electronic applications. For everyone selling adhesives to the semiconductor and components assembly market, an ongoing trend is the growing use of formulations called snap cure that cure in as little as 30 seconds and have lower temperature requirements. A second innovation gaining ground is flip chips, in which inverted semiconductors are bound directly to the lead frame with conductive epoxy adhesive.

USA

Accession no.630265

Item 292

Journal of Thermoplastic Composite Materials

10, No.1, Jan.1997, p.51-60

**EVALUATION OF MATERIALS FOR
COMPOSITE REPAIR APPLICATIONS**

Mehrkam P A; Cochran R

US, Naval Air Warfare Center

Details are given of the evaluation of series of epoxy resin adhesive formulations for the repair of complex shaped graphite fibre-reinforced epoxy resin aircraft structures. The repair applications include structural bonding, wet lay-up patches, honeycomb core splicing, back side sealing, and filling small scratches. The adhesives were tested to determine compatibility with repair procedures, mechanical strength, and thermal stability. 9 refs.

USA

Accession no.629765

Item 293

Adhesives Age

40, No.2, Feb.1997, p.57-8

ENGINEERING ADHESIVES OFFER JOINING ADVANTAGES

Bowtell M

A memorial lecture was given at the 84th Thomas Hawksley Memorial Lecture, consisting of an overview of the use of adhesives in engineering. It was emphasised that in order to understand the science involved in adhesive bonding, skills and knowledge from other disciplines are needed, and that advances made in applying the concepts of fracture mechanics to adhesive joints provide a better understanding of the fundamentals of adhesion. Advantages and disadvantages of using engineering adhesion technology were cited, and the importance of predicting the strength and service life of adhesive joints and their durability was addressed.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.629702

Item 294

Journal of Adhesion

61, Nos.1-4, 1997, p.71-95

FATIGUE AND DURABILITY BEHAVIOUR OF AUTOMOTIVE ADHESIVES. I. FRACTURE MECHANICS TEST

Jethwa J K; Kinloch A J

London,Imperial College of science,technol.& med.

A fracture mechanics approach was successfully used to examine the cyclic fatigue behaviour of adhesively-bonded joints, which consisted of aluminium alloy or electrogalvanised steel substrates bonded using toughened epoxy resin structural paste adhesive. The adhesives were typical of those being considered for use, or in use, for the automobile industry. The results were plotted in the form of the rate of crack growth per cycle versus the maximum strain energy release rate, applied in the fatigue cycle, using logarithmic axes. 22 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.629097

Item 295

Leicester, c.1996, pp.6. 12ins. 14/6/96.

BOSTIK ENGINEERING RANGE

Bostik Ltd.

A product selector chart is presented which gives details of Bostik's range of adhesives and sealants for engineering applications. Included are products for threadlocking, threadsealing, gasketing, retaining, superglues and structural adhesives. Brief product characteristics and typical applications are indicated for each.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.628362

Item 296

International Journal of Adhesion & Adhesives

17, No.1, Feb.1997, p.33-8

LOCUS OF FAILURE OF T-PEEL JOINTS FORMED BETWEEN ALUMINIUM AND VARIOUS ADHESIVES

Brewis D M; Critchlow G W

Loughborough,University

Joints were prepared by bonding pretreated aluminium alloy L61 with either a one-part epoxide (Araldite 2007), a two-part epoxide (Araldite 2001) or a two-part PU (3M's 3532). The joints were then immersed in water at 60C for periods up to 119 days before being broken in a T-peel test. Following a phosphoric acid anodisation treatment, the one-part epoxide and the PU clearly failed cohesively within the adhesive. When inspected using a magnifying glass or a low powered microscope, the other systems (chromic acid etch/one-part epoxide, chromic acid etch/two-part PU, phosphoric acid anodisation/two-part epoxide) gave apparent interfacial failure. Auger electron spectroscopy was used to determine the true locus of failure. Three distinct failure modes were found, i.e. interfacial failure, cohesive failure within the adhesive and failure within the oxide. 11 refs.

3M CO.; CIBA-GEIGY

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.626582

Item 297

International Journal of Adhesion & Adhesives

17, No.1, Feb.1997, p.27-32

SMALL SCALE ALUMINIUM/EPOXY PEEL TEST SPECIMENS AND MEASUREMENTS OF ADHESIVE FRACTURE ENERGY

Price A J; Sargent J P

British Aerospace

A small 2 mm wide and 25 mm long peel specimen was used to obtain the adhesive fracture energy for specimens composed of a toughened epoxy resin adhesive (3M's AF 163-2K) with aluminium adherends. The specimen was prepared from the unpulled ends of existing floating roller peel test specimens used by the aerospace industry as part of the routine quality control procedure. Specimens were prepared with the thinner adherend polished down to give specimens with a range of different adherend thicknesses, with failure occurring at or near the interface between adhesive and the adherend oxide. Estimates of adhesive fracture energy for failure in this region were made by using recently-developed analytical methods. Measurements were also obtained on the force required to bend thin strips with the same dimensions as those used for the peeling experiments. These served as a simulation of that part of the peel load resulting from energy dissipation in the peeling adherend arm and the results were compared with predictions. The influence of peel

specimen width on measuring peeling load was also investigated. 7 refs.

3M CO.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.626581

Item 298

Journal of Materials Science

32, No.4, 15th Feb.1997, p.879-86

**INVESTIGATION OF MOISTURE INGRESS
INTO ADHESIVE BONDED STRUCTURES
USING HIGH FREQUENCY DIELECTRIC
DISCHARGE**

Li Z-C; Hayward D; Gilmore R; Pethrick R A
Strathclyde, University

The effects on the dielectric characteristics of aluminium-epoxy adhesive bonded joints with different surface treatments on exposure to moisture at elevated temperatures are discussed. Three major ageing processes were identified by analysing the frequency domain data as a function of the exposure time. 26 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.626486

Item 299

Journal of Adhesion

60, Nos.1-4, 1997, p.141-52

**PLASMA-SPRAYED ALUMINIUM AND
TITANIUM ADHERENDS. II. DURABILITY
STUDIES FOR WEDGE SPECIMENS BONDED
WITH POLYIMIDE ADHESIVE**

Wolfe K L; Dillard J G; Harp S R; Grant J W
Virginia, Polytechnic Institute & State University

The durability of plasma-sprayed metals bonded with a polyimide adhesive was studied. Metal adherend surfaces were prepared for adhesive bonding by plasma-spraying inorganic powders (alumina, aluminium phosphate, magnesium oxide and silica) on aluminium and titanium. It was found that the durability of adhesively-bonded, plasma-sprayed adherends was equivalent to that for adherend surfaces prepared by standard chemical treatments when tested using cyclic environmental exposure conditions. Durability performance was enhanced for thin compared with thick plasma-sprayed coatings. The mechanical, rather than the chemical, properties of the coatings appeared to play a significant role in determining the failure processes. 27 refs.

USA

Accession no.625085

Item 300

Journal of Adhesion

60, Nos.1-4, 1997, p.51-69

**SULFUR VERSUS NON-SULFUR CONTAINING
POLYIMIDE ADHESIVES FOR BONDING
STEEL**

Ellison M M; Taylor L T

Virginia, Polytechnic Institute & State University

The effect on bond strength of thioether sulphur in the polyimide backbone was investigated. Bonds were made using steel, which was thought to catalyse the oxidation of sulphur. In addition, non-sulphur-containing polyimides with similar T_g were also studied for comparison. The polymer/metal interface was studied using both the T-peel and wedge tests. No apparent effect was observed in the T-peel test with steel, where the T-peel strengths of non-sulphur and sulphur-containing polyimides were similar. In the wedge test, however, the sulphur-containing 4,4'-bis(3,4-dicarboxyphenoxy)-diphenyl sulphide dianhydride/4,4'-diaminodiphenyl ether bonded to steel had the smallest initial crack length of 34 mm. The 3,3',4,4'-benzophenonetetracarboxylic acid dianhydride(BTDA)/3,4-bis(aminophenoxy)benzene bonds tested in a dry environment, however, had the smallest crack growth. The sulphur-containing BTDA/4,4'-diaminodiphenyl sulphide performed best of the bonds tested in a wet environment. Metal-catalysed oxidation of sulphur was observed to take place in the case of steel, but to have no noticeable effect on peel strength. 27 refs.

USA

Accession no.625080

Item 301

Journal of Adhesion

60, Nos.1-4, 1997, p.15-26

**CHEMISTRY AND ADHESIVE PROPERTIES OF
PHENYLETHYNYL-TERMINATED
PHENYLQUINOXALINE OLIGOMERS**

Connell J W; Smith J G; Hergenrother P M
US, NASA Langley Research Center

Phenylethynyl-terminated phenylquinoxaline oligomers were prepared by conventional and aromatic nucleophilic displacement routes and chain-terminated with mono- or di(phenylethynyl) groups. The oligomers were melt-pressed into thin films, compression-moulded into tensile and compact tension specimens and fabricated into titanium-to-titanium single lap shear adhesive specimens (as used in the aeronautical industry). The oligomers were generally compression-moulded for 1 h at 350C under pressures ranging from 0.10 to 1.4 MPa. The phenylquinoxaline oligomer prepared via aromatic nucleophilic displacement exhibited better processability and higher tensile shear strengths than those of the oligomers prepared via the conventional synthetic route. The synthesis, physical and mechanical properties of these oligomers and their cured polymers are presented. 28 refs.

USA

Accession no.625077

Item 302

Adhesives Age

39, No.13, Dec.1996, p.22/32

LIGHT CURING ADHESIVES IN ELECTRONICS MANUFACTURING: THREE CASE STUDIES

Swanson P

Intertronics

It is well known that adhesives use is growing throughout all industries, not just electronics, but it is surprising to find that industry spends more money on materials and accessories for adhesive bonding than for welding. It will not be many years before that adage is amended to include soldering as well. It is said that designers still regard adhesive technology with some suspicion, although this should not be the case in the electronics industry. The construction of the circuit board itself uses adhesive technology, as do most of the components on it. By volume, there is certainly more adhesive and protective resin than metal in a PCB assembly. However, production managers and process engineers need to be given confidence that adhesives do not need to be applied in either near laboratory conditions; practical adhesive application can be clean, fast and economical. 8 refs.

USA

Accession no.617925

Item 303

Patent Number: US 5512625 A 19960430

THERMOPLASTIC HOT MELT ADHESIVE

Butterbach R; Kopannia S; Andres J

Henkel KgaA

A thermoplastic hot-melt adhesive based on a polymer blend of polyolefins is disclosed. An oligomer of an alpha-olefin with at least eight carbon atoms in the monomer and a molecular weight of the oligomer of up to 5,000, as well as other known additives, are added to the known mixture of a substantially amorphous poly-alpha-olefin and of a substantially crystalline poly-alpha-olefin. The impact strength, the viscosity and the flexibility at low temperatures are all improved in this manner. These hot-melt adhesives are therefore suitable above all for gluing non-polar plastics in the automobile and electrical industries.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.617302

Item 304

Machine Design

68, No.21, 21st Nov.1996, p.88-91

ADHESIVES FORCE A LOCK ON THREADS

Perkins J G

Loctite Corp.

This article discusses the uses of so-called threadlocking adhesives, which prevent bolts from loosening by completely filling the microscopic gaps between

interfacing threads. These are anaerobic agents which can last the life of an assembly in a properly-designed joint.

USA

Accession no.612376

Item 305

150th ACS Rubber Division Meeting. Fall 1996.

Conference Preprints.

Louisville, Ky., 8th-11th Oct.1996, Paper 85, pp.16. 012

AQUEOUS ADHESIVES AS AN ALTERNATIVE TO CONVENTIONAL RUBBER-TO-METAL ADHESIVES

Dehnicke S

Chemetall GmbH

(ACS,Rubber Div.)

Applications of Megum aqueous adhesives and primers (Chemetall) in rubber-to-metal bonding are described, with particular reference to the manufacture of automotive components such as vibration dampers, gaskets and metal-reinforced profiles.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; USA; WESTERN EUROPE

Accession no.611840

Item 306

Medford, Ma., 1995, pp.2. 11 ins. 6/9/95.

HIGH PERFORMANCE POLYMERS FOR ADHESIVE AND CASTING APPLICATIONS

Tra-Con Inc.

Product details are given of high performance bonding adhesives and casting systems from Tra-Con Inc. A product selector chart is included for the adhesives with details of the most suitable products for bonding a variety of substrates. Brief product descriptions are given against the recommended adhesive. Viscosity, pot life, hardness and cure schedules are given for the Tra-Cast range of high performance casting systems.

USA

Accession no.610935

Item 307

Antec '96. Vol.I. Conference Proceedings.

Indianapolis, 5th-10th May 1996, p.1219-24. 012

LASER SURFACE MODIFICATION OF POLYMERS TO ENHANCE ADHESION. I. POLYOLEFINS

Tavakoli S M; Riches S T

TWI

(SPE)

The surfaces of HDPE, LDPE, PP and glass fibre-reinforced PP samples were treated with xenon chloride, arsenic fluoride and krypton fluoride excimer lasers to enhance adhesion. Single lap shear joints were prepared using a polycyanoacrylate adhesive. The failure position for many samples tested was within the adherend. SEM studies showed

little or no physical effect on the surfaces, particularly at low frequencies, but X-ray photoelectron spectroscopy revealed some chemical changes. Specimens stored for up to 15 days after laser treatment retained their surface reactivity and could still be effectively bonded. 5 refs.

WELDING INSTITUTE

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA;
WESTERN EUROPE

Accession no.609263

Item 308

Journal of Adhesion

59, Nos.1-4, 1996, p.281-94

ADHESIVE PROPERTIES OF SILOXANE-MODIFIED POLYIMIDES AND APPLICATION FOR MULTI-LAYER PRINTED CIRCUIT BOARDS

Furukawa N; Yuasa M; Omori F; Yamada Y
Nippon Steel Chemical Co.Ltd.

The adhesive properties of various siloxane-modified polyimides were studied for the development of suitable adhesive materials with good thermal stability. The adhesive properties were affected by the siloxane content in the polymer backbone and the structure of the aromatic component. Copolyimides with small amounts of the siloxane unit showed better lap shear strength than the corresponding all-aromatic polyimides. They had very good adhesive strength to various substrates. Their adhesive durability under highly humid conditions was also improved mainly due to their lower moisture sorption and lower moisture permeability. Further siloxane modification, however, lowered their adhesive strength and durability. The T-peel strength of copolyimides, on the other hand, was lowered with increase of siloxane content. Based on the results obtained, a new copolyimide adhesive, SPB-505A, was developed and used for production of multi-layered printed circuit boards. 12 refs. (Adhesion Society of Japan, 30th Anniversary Meeting, Yokohama, Japan, Nov.1994)

JAPAN

Accession no.608831

Item 309

Journal of Adhesion

59, Nos.1-4, 1996, p.241-50

INFLUENCE OF THE SURFACE COMPOSITION OF METALLIC SUBSTRATES ON THE REACTIVITY AND BONDING PROPERTIES OF STRUCTURAL ADHESIVES

Villoutreix G; Villoutreix J; Bretton-Pieters C;
Delsupexhe B
CNAM; Cockerill Sambre SA

The crosslinking of epoxy resins in the presence of steels plated with different alloys was studied, with the aim of examining the behaviour of the adhesive/support system and investigating the effect on reactivity of the nature of

the substrate's surface and the study of the mechanical behaviour of bonded assemblies under shearing. It was shown that, by determining the activation energy, the catalytic effect of the supports on the crosslinking of the epoxy-diamine adhesive could be demonstrated. The greater efficiency of aluminium on adhesive-substrate interactions was shown. Interaction appeared to be possible between the hydroxyl group of the epoxy resin and aluminium. 11 refs. (Adhesion Society of Japan, 30th Anniversary Meeting, Yokohama, Japan, Nov.1994)

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION;
FRANCE; WESTERN EUROPE

Accession no.608828

Item 310

Journal of Adhesion

59, Nos.1-4, 1996, p.51-9

ADHESION TO SINTERED SUBSTRATES

Shanahan M E R; Morris A E P

Paris,Ecole Nationale Superieure des Mines

Cylindrical substrates of stainless steel, both the dense metal and in sintered form, were bonded with a PU adhesive and subjected to torsional shear loading. Overall strain and load at failure were significantly higher with porous substrates and the effective energy of adhesion was typically an order of magnitude greater. Mechanical interlocking of the polymer in interstices of the metallic substrates prevented catastrophic failure after the interface had failed. The behaviour was modelled by taking the 'glueline' to be a 'composite' structure consisting both of bulk polymer and connecting fibrils. 15 refs. (Adhesion Society of Japan, 30th Anniversary Meeting, Yokohama, Japan, Nov.1994)

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.608812

Item 311

Composites

27A, No.10, 1996, p.981-87

FLEXURAL BEHAVIOUR OF REINFORCED CONCRETE BEAMS STRENGTHENED WITH CARBON FIBRE SHEETS

Takeda K; Mitsui Y; Murakami K; Sakai H; Nakamura M
Kumamoto,University; Mitsubishi Chemical Corp.

An experimental investigation is presented on the flexural behaviour of reinforced concrete (RC) beams strengthened with carbon fibre (CF) - reinforced plastic sheets. The (CF) sheets are bonded onto the beam with epoxy resin adhesive. Two series of bending tests are described using two different sized specimens. In the first test six medium sized beams are tested in four point bending to evaluate the reinforcing effects of the CF sheets. One of the test specimens is initially crack-damaged and subsequently strengthened with the CF sheets. In the second test a large sized beam specimen,

initially crack-damaged and then repaired by injecting epoxy resin into the cracks and strengthened with CF sheets, is loaded in four point bending to simulate the performance in real structures. Results indicate that flexural rigidity and strength of the RC beams are increased by reinforcing with CF sheets. CF reinforcement also improves the performance of the crack-damaged beam. 3 refs.

JAPAN

Accession no.608777

Item 312

Advanced Packaging

5, No.5, Sept/Oct.1996, p.30/2

FINDING A CURE

Vanwert B; Wilson S W; Hanlon A

Dow Corning Corp.

Electronic applications are reported to demand that adhesive products possess a number of properties in addition to good adhesion and compatibility with substrate materials. Most adhesives used in a production environment are heat cured, both for processing speed and ultimate physical properties. Flexibility is also necessary to prevent damage during temperature cycling, even if the assemblies are not subjected to extreme heat or cold. Finally, the ability to maintain physical properties in the presence of moisture, contaminants and varying temperatures is imperative for many applications. Aspects of silicone adhesives in electronic applications described include application requirements, physical properties, processing requirements, cure mechanisms and testing.

Accession no.607356

Item 313

European Adhesives & Sealants

13, No.3, Sept.1996, p.14/6

HIGH-PERFORMANCE BONDING IN VEHICLE MANUFACTURE

Keller H

Ford Werke AG

The use of structural adhesives for bonding joints in automotive applications at Ford Werke AG is examined. Factors influencing the growth of structural adhesives in such applications are considered, in particular quality assurance methods, the ability to use robots, environmental influences, and reliable application technology such as the piston dosing systems used at Ford.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.606945

Item 314

Journal of Polymer Science : Polymer Physics Edition

32, No.14, 15th Nov.1994, p.2421-33

ATR ANALYSIS OF THE OIL-ABSORPTION

ABILITY OF A TWO-PART EPOXY ADHESIVE ON OIL-CONTAMINATED METAL SUBSTRATES

Hong S G; Shu H X

Yuan Ze, Institute of Technology

The oil absorption behaviour of a room temperature cured, two-part epoxy adhesive on cold rolled steel, 2024-aluminium and electrogalvanised steel substrates was studied by means of attenuated total reflection infrared spectroscopy. Results showed that as much as a 20 micron thickness of oil could be absorbed from the cold rolled steel and aluminium substrates, but much less from the electrogalvanised steel. However, heat applied during cure greatly increased the absorption of oil from this last substrate. More oil-compatible amide-containing molecules were present in the adhesive resin near the oiled metal surfaces than further away. The oil absorption behaviour was thought to result from the different amounts of curing agents adsorbed on the metal surfaces. The preferential adsorption of curing agents on to the electrogalvanised steel surfaces resulted in an oil-incompatible, epoxy-rich layer near the adhesive/substrate interface, which blocked oil absorption. The oil did not appear to inhibit the cure of the adhesive. 39 refs.

TAIWAN

Accession no.604823

Item 315

Revista de Plasticos Modernos

69, No.466, April 1995, p.347-9

Spanish

BONDING WITH ADHESIVES: SOME INTERESTING EXAMPLES

Jacobs H H

IPS Jacobs H.

Three examples are presented of the application of adhesive bonding techniques and equipment in industrial processes. These include the use of PU adhesives for bonding PU foam covered fabrics to ABS mouldings in the manufacture of vehicle doors and for the installation of PS foam roof panels, and the application of an adhesive in an automatic process for packaging delicate profiles in cardboard boxes.

STEINMEYER H., KLEBETECHNIK

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.598453

Item 316

Composites Plastiques Renforcees Fibres de Verre Textile

No.8, March/April 1995, p.85-91

French

MOSAIC PROJECT: INTRODUCTION OF COMPOSITES INTO AUTOMOTIVE STRUCTURES

Valersteinas P

Renault SA

Details are given of the Mosaic project undertaken by Renault in collaboration with a number of materials suppliers to investigate the use of glass fibre-reinforced composites in car construction. The study resulted in the design and production of a hybrid aluminium/composite structure, giving significant weight savings. Types of composites and moulding processes used, the application of PU and epoxy resin structural adhesives for component assembly, results of studies of vehicle performance, and possible methods for the recycling of automotive composites are reviewed.

DSM NV; ENICHEM SPA; MONTEDISON SPA;
CIBA-GEIGY AG; GURIT-ESSEX AG
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
GERMANY; ITALY; NETHERLANDS; SWITZERLAND;
WESTERN EUROPE

Accession no.595301

Item 317

Revue Generale des Caoutchoucs et Plastiques

No.740, April 1995, p.64-6

French

**TAKEOFF OF THE HIGH-FREQUENCY
BONDING TECHNIQUE**

Bernard J P; Charon B

Sairem; Ceca-GRL

The development of a process for the high-frequency bonding of composite automotive components using a two-component PU adhesive is described. The technical and economic advantages of this bonding technique are examined in comparison with the traditional hot air oven process. 4 refs.

PEUGEOT SA; PSA; INSTITUT TEXTILE DE
FRANCE; CITROEN SA; CENTRE TECHNIQUE
DES INDUSTRIES AERNAUTIQUES ET
THERMIQUES; MANDUCHER SA; ELECTRICITE
DE FRANCE; CECA SA; INERGA
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
SPAIN; WESTERN EUROPE

Accession no.595261

Item 318

Urethanes Technology

13, No.3, June/July 1996, p.6

DIRECT GLAZING PROSPECTS

Trends in the use of direct glazing sealants and adhesives in the West European automotive sector are reviewed with reference to a study carried out by Eurotrends Research Ltd. The study which covers the period 1995-2000, claims that by 2000 consumption of adhesives and sealants in this application will amount to 20,000 tonnes, representing an annual growth-rate of 7% a year. Further trends in primers and primerless systems, and designs of rubber gaskets, profiles and window encapsulation are indicated.

EUROTRENDS RESEARCH LTD.
WESTERN EUROPE-GENERAL; WESTERN EUROPE

Accession no.594144

Item 319

Patent Number: US 5457149 A 19951010

**REWORKABLE ADHESIVE FOR ELECTRONIC
APPLICATIONS**

Hall J B; Hogerton P B; Pujol J-M

Minnesota Mining & Mfg.Co.

Reworkable adhesives are claimed that have a higher shear strength through a range of use temperatures but which have a low strength and are reworkable at a suitable processing temperature.

USA

Accession no.593136

Item 320

International Journal of Adhesion & Adhesives

16, No.2, May 1996, p.113-9

**FRACTURE MECHANICS STUDY OF THE
INFLUENCE OF MOISTURE ON THE FATIGUE
BEHAVIOUR OF ADHESIVELY BONDED
ALUMINIUM-ALLOY JOINTS**

Fernando M; Harjoprayitno W W; Kinloch A J

London, University, Imperial College

A fracture mechanics approach was used to examine the cyclic fatigue behaviour of adhesively bonded joints consisting of Al-alloy substrates bonded using a toughened-epoxy structural adhesive. The results were plotted in the form of the rate of crack growth per cycle versus the maximum strain energy release rate, G_{max} , applied in the fatigue cycle, using log. axes. The cyclic fatigue tests conducted in a relatively dry environment of 23C and 55% RH were shown to cause crack propagation at far lower rates of G_{max} compared with the value of the adhesive fracture energy, which was determined from monotonically loaded fracture tests. Cyclic fatigue tests were also conducted in a 'wet' environment, i.e. immersed in distilled water at 26C. The 'wet' fatigue tests clearly revealed the further significant effect an aggressive, hostile environment might have on the mechanical performance of an adhesive joint and highlighted the important effect that the surface pretreatment, used for the substrates prior to the bonding, had upon joint durability. The development and standardisation of 'wet' fatigue tests could provide the basis for a very effective accelerated ageing test. 18 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.591306

Item 321

Adhesives Age

39, No.5, May 1996, p.24-5

**AIRCRAFT REPAIR STATION SPEEDS
TURNAROUND**

It is reported that for fast turnaround on damaged aircraft composite parts, repair stations rely on easy-to-handle, rapid curing materials. American Composites, an FAA

repair station located in Florida's Hialeah Gardens near the Miami International Airport, is responding to customer repair, modification and overhaul requirements quickly and more economically with a new Accustick epoxy syntactic from Ciba Aerospace Products. Other Ciba materials frequently used for composite repairs include Epocast 1680-A/B (liquid version of Accustick), Epibond 8543 A/B adhesive and Epocast 50-A/9816 laminating system. Details are given.

AMERICAN COMPOSITES; CIBA AEROSPACE PRODUCTS
USA

Accession no.590393

Item 322

ICCM/9. Volume 6: Composites Properties and Applications. Conference Proceedings. Madrid, 12th-16th July 1993, p.224-31. 627
STUDY OF FIBRE COMPOSITE PLATES FOR STRENGTHENING REINFORCED BRIDGES
Wang Shijie; Zhang Ruixian
Chongqing, Institute of Communications
Edited by: Miravete A
(Zaragoza, University)

Techniques for repairing reinforced concrete road bridges with glass fibre-reinforced plastics (GFRP) were discussed. The mechanical properties of the adhesive interphases between E-glass woven fabric-reinforced unsaturated polyester plates and reinforced concrete beams were studied in detail. The adhesives used were three different epoxy resins. The mechanical and structural properties of GFRP-strengthened reinforced concrete beams were studied and equations for calculating the flexural strength were derived. The fatigue life of GFRP-strengthened beams was found to be about three times longer than that of unstrengthened beams. The fatigue strength had an increment of 15-30% and the fatigue resistance was significantly improved. Applications for repairing two road bridges were described briefly. 3 refs.
CHINA

Accession no.588175

Item 323

Patent Number: EP 703259 A2 19960327
URETHANE MODIFIED EPOXY RESIN
Kokura M; Akimoto K; Urihara K
Asahi Denka Kogyo KK

This is either obtained by reacting 100 wt.% of a preliminary condensate (A) produced by reaction of an epoxy resin and an acid of a phosphorus compound or its salt or ester and 5 to 60 wt.% of an isocyanate group-terminated urethane prepolymer (B) produced by reaction of a hydroxy compound and an organic polyisocyanate compound or by preparing a urethane-modified epoxy resin (D) from 100 wt.% of an epoxy resin and 5 to 60 wt.% of the same isocyanate group-terminated urethane

prepolymer and causing the resin D to react with an acid of the phosphorus compound, its salt or ester. It can be used with an active organic hardening agent to produce an adhesive composition, which is highly effective for bonding iron and non-ferrous metals, particularly in terms of shear strength and peel strength.

JAPAN

Accession no.587870

Item 324

3rd International Conference on Deformation and Fracture of Composites. Conference Proceedings. Guildford, 27th-29th March 1995, p.277-86. 627;951
FAILURE OF FIBRE COMPOSITES AND ADHESIVELY BONDED FIBRE COMPOSITES UNDER HIGH RATES OF TEST
Blackman B R K; Dear J P; Kinloch A J; MacGillivray H; Wang Y; Williams J G; Yayla P
Imperial College of Science, Technology & Medicine (Institute of Materials)

Interlaminar fracture energy was measured in mode I, mode II and mixed mode I/II tests as a function of test rate for unidirectional carbon fibre-reinforced epoxy resin and polyether-etherketone composites. These specimens did not show any significant decrease in toughness with increasing test rate. Carbon fibre-reinforced epoxy resin joints bonded with epoxy resin adhesives were also studied in mode I as a function of test rate. These specimens were more susceptible to decreases in toughness at high test rates. Finite element modelling showed that the dynamic energy release rate oscillated during a high speed double cantilever beam test, possibly partly explaining the observed transient stick-slip crack growth behaviour. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.586745

Item 325

Composite Materials in Maritime Structures. Vol.II. Practical Considerations. Cambridge, Cambridge University Press, 1993, p.43-62. 627;6N2
ROLE OF ADHESIVES
Winkle I E
Glasgow, University
Edited by: Sheno R A; Wellicome J F
(Southampton, University)
Cambridge Ocean Technology Series 5

The application of structural adhesives based on PU, epoxy and acrylic resins to the bonding of composites is discussed. The mechanical and thermal properties of adhesive joints and effects of loading, joint geometry and marine environments are examined. Surface preparation methods, dispensing, clamping and curing procedures and quality assurance of bonded joints are also reviewed. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.586681

Item 326

Journal of Materials Science

31, No.7, 1st April 1996, p.1925-35

**DELAMINATION OF FILLER-INCORPORATED
AUTOMOTIVE EPOXY ADHESIVES FROM
DIFFERENT STEEL SUBSTRATES UPON
EXPOSURE TO DISTILLED WATER AND
SODIUM CHLORIDE SOLUTIONS UNDER
APPLIED BENDING STRESSES**

Tai R C L; Szklarska-Smialowska Z

Ohio,State University

Delamination of four filler-incorporated automotive epoxy adhesives from five different steel substrates was studied using a three-point bending device. The bent specimens were exposed to distilled water and NaCl solutions with different concentrations from 1 to 5 weeks. It was found that the degree of adhesive delamination increased with the concentration of the sodium chloride solution and with the magnitude of the applied bending stresses. The degree of the adhesive delamination was reduced by increasing hardness of the adhesives and with increasing content of fillers in the adhesives. In addition, the rank of the steel substrates in terms of their bonding resistance against adhesive delamination was determined. It was believed that the adhesion between the adhesives and the steel substrates was governed by the surface roughness of the steel substrates. 27 refs.

USA

Accession no.586622

Item 327

Euradh '94. Conference Proceedings.

Mulhouse, 12th-15th Sept.1994, p.299-303. 9(12)4

**PRACTICAL PRETREATMENTS AND
DURABILITY OF ADHESIVE BONDS WITH
ALUMINIUM**

Magnusson A; Norlin A

Granges Technology Centre

(Societe Francaise du Vide; Institute of Materials;

Dechema Institut)

Several pretreatments for various aluminium alloys (vapour degreasing, brushing, boehmite treatment, lacquering (epoxy and polyester), yellow chromate treatment and different types of anodising) were tested for their effect on adhesive bonding with an aluminium filled epoxy adhesive, sometimes together with a primer. Four different environments were studied and the mechanical strength of single lap shear specimens was determined before and after ageing. The results were discussed.

SAPA; FINSPONG ALUMINIUM AB; GRANGES
FORAL

SCANDINAVIA; SWEDEN; WESTERN EUROPE

Accession no.584860

Item 328

Euradh '94. Conference Proceedings.

Mulhouse, 12th-15th Sept.1994, p.284-8. 9(12)4

FATIGUE BEHAVIOUR OF ADHESIVE JOINTS

Kinloch A J; Jethwa J K K; Osiyemi S O

London,University,Imperial College

(Societe Francaise du Vide; Institute of Materials;

Dechema Institut)

The fatigue performance of structural adhesives for bonding thermoplastic and thermosetting composites and metals was examined by relating the maximum applied strain energy release rate to the rate of crack growth through the adhesive layer. The double cantilever beam specimen was used to study mode I fatigue crack growth for composite substrates (a carbon fibre/epoxy and a carbon fibre/PEEK composite) and a tapered double cantilever beam was used for the aluminium alloy substrates. The adhesives used were a heat cured rubber modified epoxy film adhesive and a one-part heat cured rubber modified epoxy paste adhesive. A model was proposed which uses data from the experimental fatigue results to predict theoretically the service life of other types of bonded joints. Results from the proposed model agreed well with experimental results. 6 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.584857

Item 329

Euradh '94. Conference Proceedings.

Mulhouse, 12th-15th Sept.1994, p.277-83. 9(12)4

**DURABILITY OF METAL BONDED JOINTS IN
MOTOR VEHICLE CONSTRUCTION**

Lachmann E

Industrieanlagen Betriebsgesellschaft mbH

(Societe Francaise du Vide; Institute of Materials;

Dechema Institut)

Investigations on the long-term behaviour of adhesive bonded metal joints were carried out on lap shear specimens of sheet steel and aluminium alloys and on typical structural specimens. Different types of hot curing epoxy resins were used as structural adhesives for the joints. Lap shear strength tests and fatigue tests under tension loading were conducted in the as-received condition and after weathering. Microstructural investigations of fracture surfaces of tested specimens gave evidence as to the damage process and damage character. It was concluded that adhesive bonding showed a satisfactory consistency for use in primary structural parts of motor vehicles, given appropriate selection of structural adhesives and types of metal. Fatigue life and stresses were well above those of comparable assemblies made by joint pointing. Combined jointing assemblies

such as spot welded or clinched adhesive bonds showed no differences compared with bonded-only joints. 4 refs.

ALCAN; ALUSUISSE; VAW ALUMINIUM AG;
AUDI AG; BMW AG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE

Accession no.584856

Item 330

Euradh '94. Conference Proceedings.
Mulhouse, 12th-15th Sept.1994, p.272-6. 9(12)4
**STRUCTURAL BONDING OF ALUMINIUM IN
AUTOMOTIVE APPLICATIONS**

Powel J H
Ciba Polymers
(Societe Francaise du Vide; Institute of Materials;
Dechema Institut)

The use of lightweight materials to replace steel in automobile body construction is discussed. Problems of using plastics for this application are mentioned and it is suggested that, for mass producers of cars, aluminium sheet construction, aided by adhesive bonding, is an attractive way of manufacturing lightweight, recyclable B.I.W. structures. The selection of appropriate adhesives is examined. Ciba Polymers and Alcan have collaborated to produce an adhesive which is compatible with the pretreatment and press lubricant used for producing aluminium sheets for structural parts in the automotive industry. The adhesive also has the balance of properties needed to satisfy the conditions for structural bonding.

ALCAN INTERNATIONAL LTD.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.584855

Item 331

Journal of Materials Science Letters
15, No.6, 15th March 1996, p.469-72
**EFFECT OF SURFACE TREATMENT ON THE
FATIGUE FAILURE BEHAVIOUR OF
STRUCTURAL ADHESIVE JOINTS**

Abdo Z; Aglan H
Tuskegee,University

The effect of surface preparation on the interfacial strength and the fatigue lifetime of adhesively-bonded structural joints was studied. Aluminium sheets were mechanically pretreated with Scotch Brite abrasive cloth, degreased and then scrim cloth structural adhesive prepreg (AF-163-2K from 3M) was applied on one of the substrates. SEM examination of the fractured surface was also performed to identify the failure mechanisms associated with different surface preparation methods. 10 refs.

3M CO.
USA

Accession no.584604

Item 332

Journal of Applied Polymer Science
59, No.11, 14th March 1996, p.1751-8
**EFFECTS OF THE SURFACE STATE OF
PLASTICS ON ADHESIVE STRENGTH IN
ELECTROLESS PLATING**

Sugihara S; Okada S; Ohtsuka H; Yamaki J
Tokushima Bunri,University; NTT Interdisciplinary
Research Laboratories

Adhesive resins with high adhesive strength and high heat resistance were studied in the development of an iron-core printed circuit board with high mechanical strength and high heat radiation capability. A reticular pattern formed on the surface of an adhesive resin composed of nitrile rubber, phenolic resin and epoxy resin. It caused blisters in the plating or reduced the heat resistance of the printed board. This pattern was formed as a result of phase separation of epoxy resin or phenolic resin from the nitrile rubber. Using a high molec.wt. epoxy resin led to high adhesive strength and high heat resistance, without phase separation. The relationships between the composition of adhesive resins and their characteristics are discussed on the basis of the state of their surface after being roughened by chemical etching. 16 refs.

JAPAN

Accession no.582879

Item 333

Journal of Adhesion
55, Nos.1-2, 1995, p.123-49
**TIME DEPENDENT CRACK GROWTH AND
LOADING RATE EFFECTS ON INTERFACIAL
AND COHESIVE FRACTURE OF ADHESIVE
JOINTS**

Rakestraw M D; Taylor M W; Dillard D A; Chang T
Virginia,Polytechnic Institute & State University

Double cantilever beam fracture specimens were used to investigate rate-dependent failures of model epoxy/steel adhesively-bonded systems. Quasi-static tests exhibited time-dependent crack growth and the maximum fracture energies consistently decreased with debond length for constant crosshead rate loading. It was also possible to cause debonding to switch between interfacial and cohesive failure modes by simply altering the loading rate. These rate-dependent observations were characterised using the concepts of fracture mechanics. The time rate of change of the strain energy release rate was introduced to model and predict failure properties of different adhesive systems over a range of testing rates. 40 refs. (Adhesive & Sealant Council, Fall Convention, St.Louis, Missouri, USA, Oct.1993)

USA

Accession no.582553

Item 334

Journal of Adhesion

54, Nos.1-4, 1995, p.47-55

PLASMA SPRAY TREATMENTS FOR STEEL ADHERENDSDavis G D; Groff G B; Biegert L L; Heaton H
Martin Marietta Laboratories; Thiokol Corp.; Atlantic Research Corp.

Plasma-sprayed Ni-Cr and Ni-Cr-Zn coatings were shown to protect steel adherends from corrosion in ambient and accelerated environments (up to eight days in alternate immersion and emersion in salt water for Ni-Cr-Zn coatings). The coatings exhibited high bondability to rubber and epoxy adhesives. Peel and tensile button pull tests failed within the polymer for bonds formed on both 'as-sprayed' surfaces and surfaces subjected to aggressive environments. The coatings provided long hold times prior to bonding and were tolerant to processing and handling damage or defects. 8 refs. (Adhesive & Sealant Council, Fall Convention, St. Louis, Missouri, USA, Oct.1993)

USA

Accession no.582450

Item 335

Adhesives Age

39, No.2, Feb.1996, p.26-8

ADHESIVES OVERCOME DESIGN HURDLE FOR OXYGEN CONCENTRATOR SYSTEM

The use is described of Permabond ESP 308 one-component epoxy adhesive for bonding and sealing the aluminium components of an oxygen concentrator manufactured by SeQual Technologies, for use in in-home applications. The company were looking to replace the conventional methods of brazing their patented Advanced Technology Fractionator, which was an expensive method and one which involved sending the parts to be processed externally.

SEQUAL TECHNOLOGIES INC.; NATIONAL
STARCH & CHEMICAL CO.,PERMABOND DIV.
USA

Accession no.580544

Item 336

International Polymer Science and Technology

22, No.8, 1995, p.T/92

COLD-HARDENING ADHESIVES WITH IMPROVED SERVICE CHARACTERISTICSKerber M L; Shade L G; Gorbunova I Yu;
Dzhanaeva I A; Tseitlin G M

Mendeleyev, Institute of Chemical Technology

A new highly active amine hardener (Ot-1) has been developed for epoxy adhesives, making it possible to produce bonded joints at room temperature with high strength characteristics and water and alkali resistance. Data on shear bond strength of aluminium joints after

holding times of up to 48h at 25C show how stronger bonds are formed in shorter times than with a known aminophenol hardener (AF-2). Rapid-hardening adhesives based on epoxy oligomer ED-20 and hardener Ot-1 can be widely used for the bonding and repair of products of different materials, including products used under conditions of increased humidity.

RUSSIA

Accession no.580323

Item 337

148th ACS Rubber Division Meeting. Fall 1995.
Conference Preprints.Cleveland, Oh., 17th-20th Oct.1995, Paper 70, pp.13.
012**IONOTHANE: COMBINATION OF PERFORMANCE AND ENVIRONMENT. II. ARAMID FIBRES AND ADHESION TO ELASTOMERS: APPLICATION AND PERFORMANCE**van der Pol J F; Papegaaij P E; de Vos L J
Akzo Nobel Aramid Products
(ACS,Rubber Div.)

The use of Ionothane PU ionic resin aqueous dispersions (Akzo Nobel) in predips for promoting adhesion between aramid fibres and rubbers in power transmission belting is discussed. 10 refs.

USA

Accession no.580253

Item 338

Polymer Engineering and Science

35, No.24, Dec.1995, p.1972-8

THIN-FILM THERMOPLASTIC-METAL JOINING PROCESS FOR TITANIUM TO POLYETHERKETONEETHERKETONEKETONE(PEKEKK)Ramani K; Tagle J; Devanathan D; Nazre A; Swarts D;
Lin S
Purdue University; Zimmer Inc.

The role of processing in thermoplastic joining of a titanium alloy using thin film PEKEKK was investigated. A design of experiments was performed to determine the effects of the soak above melt temp.(T_m), hold at the isothermal recrystallisation temp.(T(iso)) and cooling rates on the joint strength. Extended soak times were required to remove the residual spherulitic crystallinity in the polymeric adhesive. With the elimination of the residual crystallinity, high-strength transcrystalline regions were enhanced at the polymer-metal interface during the hold time at T(iso) and during cooling to ambient temp. Average TSs of 137 MPa were achieved, exceeding the bulk polymer TS of 118 MPa by 16%. X-ray photoelectron spectroscopy and SEM showed that extended soak times above T_m led to excessive polymer squeeze-out, resulting in the creation of strength-reducing shrink voids or unwetted regions. As a result, the failure

mode of the joint, which was normally cohesive for high-strength joints, became a mix of cohesive and adhesive in parts with excessive polymer squeeze-out. 15 refs.

USA

Accession no.580180

Item 339

Polymat '94 - Polymer Technologies for Electronics. Conference proceedings.

London, 19th-22nd Sept.1994, p.403-6. 6E

ADHESIVES FOR OPTOELECTRONIC DEVICES

Bartholomew P M

TWI

(Institute of Materials)

The concept for low cost, high volume devices for advanced fibre optic communications is unlikely to become a reality unless more cost-effective manufacturing methods become available. Current methods for alignment and fixing of optical fibres within opto-electronic components are generally based on laser welding or soldering techniques, which are often required to achieve alignment stabilities in the order of fractions of a micron in the case of single-mode applications. The adhesive performance criteria of major significance in optoelectronic components are reviewed. The lack of recognised test procedures for some adhesive properties, in particular those connected with mechanical alignment stability, is highlighted. 4 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.579683

Item 340

International Journal of Adhesion & Adhesives

15, No.4, Oct.1995, p.233-6

INITIAL INVESTIGATION INTO THE EFFECTIVENESS OF CARBON DIOXIDE-LASER TREATMENT OF ALUMINIUM FOR ADHESIVE BONDING

Critchlow G W; Brewis D M; Emmony D C;

Cottam C A

Loughborough,University of Technology

Aluminium alloy coupons were treated by carbon dioxide-laser ablation. The degree of surface modification was determined by a combination of Auger electron spectroscopy and SEM. Changes in lap shear joint strengths using an epoxy resin adhesive are discussed. Results were correlated with joint strength data using grit-blasted adherends. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.579351

Item 341

Antec '95. Vol.II. Conference Proceedings.

Boston, Ma., 7th-11th May 1995, p.2532-6. 012

PREADHESION LASER SURFACE TREATMENT OF CARBON FIBRE-REINFORCED PEEK

Dodiuk H; Buchman A; Rotel M; Zahavi J

Rafael; Israel,Institute of Metals

(SPE)

Excimer laser irradiation was used for the preadhesion surface treatment of carbon fibre-reinforced polyether-etherketone. Joints with laser treated adherends bonded with an epoxy resin structural adhesive had higher lap shear strengths than joints with untreated or abraded adherends. Surface analysis of the laser treated adherends and fractured joints revealed morphological and chemical changes depending on the laser parameters. Durability tests showed no change in laser treated joint performance even after 60 days' exposure to 60C and 95% relative humidity. 7 refs.

ISRAEL; USA

Accession no.576565

Item 342

Reinforced Plastics

39, No.12, Dec.1995, p.32-5

UNIVERSAL ADHESIVE CAN FILL THE GAPS

Reeves J

The Crestomer range of adhesives from Scott Bader covers a wide range of marine bonding applications. The adhesives are based on a unique styrenated urethane acrylate resin, which has tensile elongation to failure of over 100% and is miscible with polyester resin. Particular features of the Crestomer range are excellent adhesion to substrates, fibres, core materials and cured laminates, toughness, resilience and flexibility, superior chemical resistance and high filler tolerance. Applications include structural and semi-structural bonding, filleting, core bonding and gap filling. Crestomer adhesives have been used in fast ferries, racing dinghies, mine hunters and racing boats.

SCOTT BADER CO.LTD.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.576495

Item 343

Houston, Tx., 1994, pp.4. 11ins. 19/6/95. 43E-9

RAPID CURING SYSTEMS FOR STRUCTURAL APPLICATIONS

Shell Chemical Co.

Physical properties are presented for grades of Epon epoxy polyacrylate resins for use in rapid curing adhesives and civil engineering applications, and also for Epi-Cure aliphatic curing agents used in the same applications.

USA

Accession no.576340

Item 344

SPI Composite Institute 49th Annual Conference.
Conference Proceedings.
Cincinnati, Oh., 7th-10th Feb.1994, paper 18-B. 627

**RECENT ADVANCES IN STRUCTURAL
ADHESIVE TECHNOLOGY FOR BONDING
SMC AND OTHER FORMS OF REINFORCED
PLASTICS**

Housenick J; Pascarella V
Ashland Chemical Co.
(SPI,Composites Institute)

It is reported that, through a combination of unique chemical synthesis, compounding and assembly process understanding, breakthrough structural adhesive technology has been developed and commercialised for bonding high volume, high performance parts in the transportation and recreational vehicle industries. The primary focus of these efforts has been to develop robust two-component, PU-based adhesives. A number of design parameters have driven the development process for these products. To more thoroughly understand adhesive technology, it has become necessary to use statistical modelling to define structure property relationships. 43 refs.

USA

Accession no.568747

Item 345

Materiaux & Techniques

82, Nos.10/11, Oct./Nov.1994, p.15-8

French

**STRUCTURAL ADHESIVES: THEIR
ADVANTAGES, SELECTION AND APPLICATION**

Siboni P
Ciba-Geigy

The advantages of bonding with structural adhesives are described. The surface preparation of metal, composite and thermoplastic substrates for bonding, the properties of bonded joints, types of dispensing equipment and curing methods are examined.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.563197

Item 346

Materiaux & Techniques

82, Nos.10/11, Oct./Nov.1994, p.9-14

French

**DIELECTRIC CHARACTERISATION OF
INDUSTRIAL ADHESIVES AS A FUNCTION OF
FREQUENCY AND TEMPERATURE FOR
MICROWAVE CURING**

Abbas M; Bernard P A; Marzat C
Bordeaux 1,Universite

Permittivity measurements as a function of temperature were used to predict the behaviour of vinyl polymer wood adhesives during microwave curing. The reactivities of

five adhesives were compared at a frequency of 2.45 GHz and temperatures from 20 to 90C. The quality of bonded joints was investigated by shear stress studies. Similar measurements were undertaken with a PU adhesive used to bond composite automotive components. Statistics are presented for the consumption of adhesives in the wood industry in France in 1990. 7 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE

Accession no.563196

Item 347

Adhesives Age

38, No.10, Sept.1995, p.64-5

STRUCTURAL ADHESIVES IN ENGINEERING
Bowtell M

A fourth international meeting addressing structural adhesives in engineering is reported to have taken place at Bristol University at the beginning of July 1995. Organised by the British Institute of Materials, it covered an extensive range of subjects. An outline of each of the papers presented at SAE IV, which targeted users of adhesives in load bearing engineering applications, is presented.

BRISTOL,UNIVERSITY; INSTITUTE OF
MATERIALS

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.562911

Item 348

Automotive Engineer

20, No.4, Aug./Sept. 1995, p.24-5

**ADDING WELDED/MECHANICAL FASTENING
TO ADHESIVE-BONDED JOINTS**

Pearson I
Warwick,University

A report is presented of a test and evaluation of adhesively bonded steel joints, assisted either by mechanical or welded fastening, with reference to applications in vehicle body fabrication. The stiffness characteristics of adhesively bonded, riveted, spot welded and press jointed T-peel joints have been determined and the changes in stiffness of the mechanically fastened joints incurred by the addition of an adhesive, are presented.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.561042

Item 349

Fibres & Textiles in Eastern Europe

3, No.1, Jan./March 1995, p.42-3

**SOME METHODS FOR IMPROVING THE
ADHESIVE PROPERTIES OF ISOTACTIC
POLYPROPYLENE. II. MODIFICATION OF THE
SURFACE PROPERTIES OF ISOTACTIC
POLYPROPYLENE USING CHEMICAL**

OXIDISING METHODS

Novak I; Dulaj M; Sestak J
Bratislava, Polymer Institute; Slovakia, Research
Institute for Textile Chemistry

Changes in the adhesive properties of isotactic PP modified with chromosulphuric acid or chromyl chloride were studied. The compounds were shown to increase the hydrophilicity of the polymer in the fine surface layer. The original physical and mechanical properties of the polymer were preserved. The dependence of free surface energy on time of PP modification and on concentration of carbonyl groups was analysed. 8 refs. (Pt.I, *ibid*, p.41-2)

SLOVAK REPUBLIC; SLOVAKIA

Accession no.559703

Item 350

Fibres & Textiles in Eastern Europe

3, No.1, Jan./March 1995, p.41-2

SOME METHODS FOR IMPROVING THE ADHESIVE PROPERTIES OF ISOTACTIC POLYPROPYLENE. I. MODIFICATION OF POLYPROPYLENE SURFACE PROPERTIES VIA ELECTRICAL DISCHARGE

Novak I; Lath D; Florian S; Dulaj M; Sestak J
Bratislava, Polymer Institute; Slovakia, Research
Institute for Textile Chemistry

The surface of isotactic PP was modified by electrical discharge, generating hydrophilic functional groups which were then grafted using acrylamide. Adhesive properties of modified PP increased as a result of improved wetting after formation of polar functional groups. Increase of wettability is significant for many applications in the textile industry (dyeing, printing, coating) and in applications where regulation of adhesive properties is required. 11 refs.

SLOVAK REPUBLIC; SLOVAKIA

Accession no.559702

Item 351

Antec 95. Volume I. Conference proceedings.
Boston, Ma., 7th-11th May 1995, p.1264-8. 012

EXPERIMENTAL INVESTIGATION OF DIFFUSION ENHANCED ADHESIVE BONDING FOR THERMOPLASTIC COMPOSITES

McKnight S H; Con R C; Scott M; Braem A; Gillespie J W
Delaware, University
(SPE)

Adherends of S-2 glass/PPS thermoplastic composite with a comoulded polysulphone surface layer, are bonded using a high performance epoxy film adhesive and a paste adhesive utilising the diffusion enhanced adhesive technique. The effects of adhesive cure cycle and final bondline thickness on bond strength are investigated. Additionally, the diffusion of thermosetting adhesives into thermoplastic polymers is studied experimentally using a

unique infrared reflection technique. This diffusion study is essential to determining an optimised cure cycle for the adhesive to promote the DEA bonding mechanism. 5 refs.
USA

Accession no.558623

Item 352

Composite Structures

31, No.3, 1995, p.235-41

EVALUATION OF FATIGUE LIFE OF ADHESIVELY BONDED CFRP PIPE/STEEL ROD JOINTS

Imanaka M; Nakayama H; Morikawa K; Nakamura M
Osaka, University; Sangyo University; Toray Industries
Inc.

Details are given of the fatigue strength of adhesively-bonded CFRP pipe/steel rod joints. A series of rotating bending fatigue tests were carried out on the joints with different lap lengths and with different pipe thicknesses. Fatigue test data are discussed on the basis of stress distribution in the adhesive layer determined by finite element analysis. Data are given for a graphite fibre-reinforced epoxy resin with an epoxy resin adhesive. 10 refs.

JAPAN

Accession no.558315

Item 353

Patent Number: WO 9500597 A1 19950105

EPOXY ADHESIVE COMPOSITION FOR BONDING OILY METAL

Marhevka V C
Minnesota Mining & Mfg.Co.

This comprises an epoxy resin having an average epoxide functionality of greater than one and an oligomeric polyester, which is, on average, terminated by at least two hydroxyl groups.

USA

Accession no.556270

Item 354

Rivestimenti & Materiali Compositi

2, No.3, June 1994, p.25-30

Italian

ADHESIVES FOR AEROSPACE APPLICATIONS

D'Antonio C

The properties required of adhesives used in aerospace applications are discussed. Adhesives based on epoxy and epoxy-phenolic resins, polyimides and polybismaleimides are examined. 5 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE; WORLD

Accession no.555524

Item 355

Journal of Adhesion

50, No.1, 1995, p.71-82

ULTRASONIC GUIDED WAVES FOR NON-DESTRUCTIVE EVALUATION(NDE) OF ADHESIVELY BONDED STRUCTURES

Rose J L; Rajana K M; Hansch M K T
Pennsylvania,State University

Guided wave technology is described for use in solving a practical ageing aircraft problem of delaminations and/or corrosion detection in either a lap splice joint or a tear strap. A Double Spring Hopping Probe is designed to achieve good contact on a curved aircraft structure. A guided wave resonance tuning concept for frequency is also discussed with reference to attaining reliable bond integrity measurements. A variety of experiments is discussed, including experiments performed during the field trial on a Boeing 737-222 aircraft. 13 refs. (Adhesion Society Inc., 17th Annual Meeting, Orlando, Feb.1994)
USA

Accession no.553754

Item 356

Journal of Adhesion

49, Nos.1-2, 1995, p.133-49

ADHESIVE BONDING OF CLEAN AND OIL-CONTAMINATED ELECTROGALVANISED STEEL SUBSTRATES

Hong S G; Boerio F J
Cincinnati,University

The performance of two-part, amidoamine-cured epoxy adhesives on clean and oil-contaminated electrogalvanised steel was studied using screening and lap shear tests. 34 refs.
USA

Accession no.553601

Item 357

Journal of Adhesion

49, Nos.1-2, 1995, p.83-96

SIMULATION ANALYSES ON THE DIFFUSION OF A RUST-PREVENTING OIL INTO AN OIL-ACCOMMODATING ADHESIVE

Ogawa T; Ochiai K; Masuichi M
Kanazawa,Institute of Technology

In recent years bonding between two steel plates was accomplished with an oil-accommodating adhesive without requiring degreasing of the steel. The exclusion process of the oil was investigated in this adhesive on the assumption that the oil was absorbed into the adhesive layer. The oil layer essentially disappeared in the initial step of curing in which the temperature was raised to 180 C, because the diffusion rate of the oil into the adhesive increased abruptly with temperature. Therefore, the bonding process in this case is not influenced by the presence of oil on the steel plates. 9 refs.

JAPAN

Accession no.553598

Item 358

3M Briefing

No.4, Feb.1995, p.5

RALEIGH BUILDS A WINNER WITH 3M'S HELP

The advantages of using adhesives to bond bicycle frames instead of welding and brazing them are discussed in some detail. It is reported that adhesives bonding is being used by bicycle manufacturer, Raleigh, for bonding the frames of their Dyna Tech and M-TRAX mountain bikes. 3M's Scotch-Weld 7823 adhesive, a high-strength, one-part, structural adhesive is said to have been used for this application.

RALEIGH INDUSTRIES LTD.; 3M UNITED KINGDOM PLC,IND.TAPES & ADHESIVES GP.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.551815

Item 359

Journal of Adhesion Science and Technology

9, No.5, 1995, p.627-45

REACTIVE ACRYLIC ADHESIVE FOR BONDING POLYOLEFINS

Fields J T; Garton A; Bell J P
Connecticut,University

An acrylic adhesive was developed for formation of strong, water-resistant structural joints with polyolefins. The two-component, lightly crosslinked, methyl methacrylate-based adhesive consisted of an anaerobic curing system in one part with a copper(II) salt catalyst in the other. Bonds formed with LDPE resulted in substrate failure upon block shear testing throughout the open time of the adhesive (45 min). The interdiffusion of the monomers into the substrates and their subsequent polymerisation was followed using several IR spectroscopy techniques. The interphase of mixed LDPE and adhesive was determined to be as thick as 1.7 mm using IR microscopy. It was concluded that the strong adhesion in the joints was the result of the interpenetration of the adhesive into the substrates. 25 refs.
USA

Accession no.551810

Item 360

Journal of Advanced Materials

26, No.3, April 1995, p.11-5

EFFECT ON ADHESION STIFFNESS DUE TO BONDED SURFACE CONTAMINATION

Heslehurst R B; Baird J P; Williamson H M
New South Wales,University

Failure of bonded joints at less than design loads is often due to either insufficient surface preparation or an inadequate adhesive cure process. The failure process is

generally recognised through adherend end peel and adhesive or cohesive failure. The typical interpretation of the failure mechanism suggests that weak bonds can only be recognised by early failure. Recent experiments, however, with aluminium/epoxy resin systems have indicated that faulty bonding does affect the adhesion stiffness and this can be detected by non-destructive testing without having to resort to destructive testing. These results are discussed and a new approach to load transfer in adhesively-bonded lap joints which possess weakened bondlines is proposed. 4 refs.

AUSTRALIA

Accession no.551754

Item 361

Adhesives Age

38, No.4, April 1995, p.45-6

FLEXCON, DOW SWITCH, ASHLAND COLLABORATE ON SWITCH ADHESIVE

The collaboration between Dow Switch and FLEXcon in the development of an adhesive for use in membrane switch manufacture, is detailed. The important considerations in the development of an adhesive suitable for such an application are discussed, and include the need for an adhesive which is capable of being repositioned, which is consistent in quality, and which has good mechanical properties. The Switchmark adhesive is an acrylic, which is able to perform well under different switch configurations.

FLEXCON CO.INC.; DOW SWITCH; ASHLAND CHEMICAL CO.

USA

Accession no.549908

Item 362

Machine Design

67, No.8, 20th April 1995, p.80/2

STRUCTURAL ADHESIVES EXPAND AUTOMOTIVE ALUMINIUM USE

Yorkgitis E M; Marhevka V C

3M Co.,Automotive Engineered Systems Div.

The use of structural adhesives has enabled car manufacturers to use more aluminium in car bodies without the reducing the strength of the components. Traditionally, aluminium, although offering weight reduction, has not been substituted for steel directly, due to its lower torsional and beam stiffness, resulting in a looser structure. Structural adhesives, however, can reinforce aluminium structures to the point where they meet or exceed the torsional stiffness of welded steel. The bonding processes are described.

USA

Accession no.549781

Item 363

International Journal of Adhesion & Adhesives

15, No.2, 1995, p.87-90

TREATMENT OF LOW ENERGY SURFACES FOR ADHESIVE BONDING

Brewis D M; Mathieson I; Wolfensberger M
Loughborough,University of Technology

Surface pretreatment methods for enhancing the adhesion to polymers with low surface energies generally either remove a region of low strength from the surface or introduce new surface functional groups. The relative importance of these two mechanisms is examined for various combinations of pretreatment and polymer. These combinations are the sodium complex and plasma treatments of fluorinated polymers, the reversible bromination of PEs and the treatment of PEEK with a flame and also with chromic acid. The epoxy adhesive used in all experiments is Araldite AV100 with HV100 hardener. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.549282

Item 364

International Journal of Adhesion & Adhesives

15, No.2, 1995, p.61-71

PRETREATMENT OF ALUMINIUM: TOPOGRAPHY, SURFACE CHEMISTRY AND ADHESIVE BOND DURABILITY

Digby R P; Packham D E
Bath,University

Bonded joints between a clad Al alloy, with different pretreatments, and an epoxy resin (Ciba-Geigy's Redux 312/5) were examined. The Boeing phosphoric acid anodisation pretreatment was compared with sulphuric acid anodising in combination with a phosphoric acid dip and a sulphuric acid/ferric sulphate etch. The topographical structure of the surface layers formed was examined by SEM and TEM in conjunction with ultramicrotome sectioning. The chemical composition of pretreated surfaces was characterised by X-ray photoelectron spectroscopy and depth profiling using argon-ion etch was performed. Adhesive bonds were prepared and their durability assessed using wedge test specimens. The data collected were used to calculate crack growth and strain energy release rate as functions of time for the bonds produced. Surfaces of failed specimens were examined in order to establish the locus of failure. 13 refs.

CIBA-GEIGY

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.549279

Item 365

Patent Number: US 5354805 A 19941011

ADHESIVE COMPOSITION FOR BONDING

NITRILE RUBBER TO METAL

Treat C J; Mowrey D H
Lord Corp.

An aqueous adhesive composition for bonding nitrile rubber is disclosed, containing a chlorosulphonated polyethylene latex, a polyhydroxy phenolic resin copolymer, and a high molecular weight aldehyde polymer. The adhesive composition exhibits an unusual affinity for nitrile rubber and excellent adhesive performance as a single-coat formulation, withstands high temperature bonding conditions and minimises the use of volatile organic solvents.

USA

Accession no.549234

Item 366

Journal of Adhesion Science and Technology

9, No.4, 1995, p.527-48

PLASMA-SPRAYED COATINGS AS SURFACE TREATMENTS OF ALUMINIUM AND TITANIUM ADHERENDS

Davis G D; Whisnant P L; Shaffer D K; Groff G B; Venables J D

Martin Marietta Laboratories; Venables & Associates

Plasma-sprayed coatings were evaluated as surface treatments for Al and Ti adherends. The best Al treatment was found to be a 50 micron thick blend of an Al-12% silicon alloy and polyester with 20-40% polyester. For FM-300M epoxy film adhesive, this coating gave a wedge test performance equivalent to phosphoric acid anodisation(PAA). For FM-123 epoxy film adhesive, its performance was between that of the Forest Products Laboratory etch and PAA. The Al in the composite coating provided structural strength and adhesion to the substrate; the polyester toughened the coating and possibly supplemented the physical bonding provided by the microscopically rough morphology with chemical bonding to the adhesive. For Ti, a 50 micron plasma-sprayed Ti-6Al-4V coating provided identical performance to the best chemical treatment with crack propagation entirely within the adhesive. These plasma-sprayed coatings avoided the disposal and environmental costs of conventional chemical treatments using chromates and strong acids or bases. They were also well suited to repair or refurbishment of existing components. 11 refs.

USA

Accession no.548087

Item 367

Journal of Adhesion Science and Technology

9, No.4, 1995, p.501-25

AMMONIA PLASMA TREATMENT OF POLYOLEFINS FOR ADHESIVE BONDING WITH A CYANOACRYLATE ADHESIVE

Wu D Y; Gutowski W S; Li S; Griesser H J
CSIRO

PP, LDPE and HDPE sheets were surface-modified by radiofrequency ammonia plasmas in order to improve the strength and durability of adhesive bonding, particularly under hot and humid conditions. Surface analyses by contact angle measurements, X-ray photoelectron spectroscopy and FTIR-ATR spectroscopy showed incorporation, upon plasma treatment, of both nitrogen- and oxygen-containing functional groups on the polyolefin surfaces, with similar surface compositions on modified LDPE and PP. Plasma-treated polyolefin samples bonded with a cyanoacrylate adhesive possessed a high shear bond strength in 'dry' conditions. On exposure to hot and humid conditions, the bond strength decreased with time in some cases while in others the lap shear strength was the same after exposure to the humid environment for 1 month compared with that under 'dry' conditions. Ammonia-plasma-treated HDPE specimens displayed the best strength retention upon water immersion. The good durability of the bond strength under humid conditions was indicative of covalent bonding between the cyanoacrylate adhesive and amine groups, which unlike physical bonding was not disrupted by the ingress of water molecules. 45 refs.

AUSTRALIA

Accession no.548086

Item 368

Journal of Adhesion

48, Nos.1-4, 1995, p.121-36

DIELECTRIC RESPONSE OF ADHESIVE JOINTS TO WATER ABSORPTION

Nairn B J; Dickstein P A; Plausinis D J; Spelt J K
Toronto,University

Dielectric measurements were used to infer the average moisture content of aluminium adhesive joints bonded with three commercial epoxy resin adhesives. Measurements were made on both aluminium-adhesive-aluminium joints and aluminium-adhesive specimens to assess the influence of moisture diffusion gradients. Similar experiments were also performed with foil electrodes embedded in the bondline. 20 refs.

CANADA

Accession no.547760

Item 369

High Performance Polymers

7, No.1, March 1995, p.11-21

ADHESIVE AND COMPOSITE PROPERTIES OF LARC-8515 POLYIMIDE

Jensen B J; Hou T H; Wilkinson S P
US,NASA,Langley Research Center; Lockheed Engineering & Sciences Co.; Williamsburg,College of William & Mary

The synthesis and development of LARC-8515, an aromatic polyimide based on 3,3',4,4'-biphenyltetracarboxylic dianhydride and an 85:15 molar ratio of 3,4'-oxydianiline

and 1,3-bis(3-aminophenoxy)benzene, are discussed, together with the effect of molec.wt. on properties. The polymer was evaluated as an adhesive for aerospace applications and titanium-titanium tensile shear strengths were determined. Unidirectional prepreg was made using the Langley multipurpose tape machine and the thermal and rheological properties and the solvent/volatile depletion rates of the polyamide acid/NMP resin system were studied. This information was used to design a moulding cycle for composite preparation. Composite laminates were moulded under 200 psi, which consistently yielded good consolidation quality as measured by C-scan, acid digestion and optical photomicrography. Composite mechanical properties measured included short-beam shear strength and 0 degree flexural strength and modulus at room temp., 93, 150 and 177C and 0 degree compression strength and open hole compression strength at room temp. and 177C (wet). 12 refs. USA

Accession no.546724

Item 370

Reinforced Plastics

39, No.3, March 1995, p.18/22

ADHESIVE TECHNOLOGY TAKES TO THE ROAD

Snowdon I

ITW Adhesive Systems

ITW Adhesive Systems has developed a new generation of structural adhesives which have found applications in the automotive sector. Advanced methacrylate technology provides significant benefits in both performance and processing. Truly elastic adhesives with elongation of 200% or more can now be formulated. Benefits of the Plexus range of methacrylate adhesives include the ability to bond dissimilar substrates, resistance to corrosion and chemicals, gap filling up to 4mm, distribution of stress and load over the complete fixture. The products also offer manual or automatic dispensing, primerless adhesion, quick room-temperature cure and recyclability. Adhesives from this range have recently been used to structurally bond the Ford Mondeo's instrument panel carrier to its defroster grill and to bond cab components of Volvo's new FH HGVs.

USA

Accession no.544140

Item 371

Polymer Plastics Technology and Engineering

34, No.1, 1995, p.117-42

STUDIES OF ADHESIVE DELAMINATION USING DC-RESISTANCE MEASUREMENT

Tai R C L; Szklarska-Smialowska Z

Ohio,State University

The delamination of three different automotive epoxy resin adhesives from two different steel substrates upon exposure to distilled water and sodium chloride solution was studied using DC-resistance measurements. Four

stages of the resistance change across the metal/adhesive/metal specimens are proposed corresponding to the different stages of bonding degradation. 18 refs.

USA

Accession no.543372

Item 372

Journal of Adhesion Science and Technology

9, No.2, 1995, p.149-58

EFFECTS OF THE ENVIRONMENT AND CURING ON THE STRENGTH OF ADHESIVE JOINTS

De Wilde W P; Van Vinckenroy G; Tirry L; Cardon A H
Brussels,Free University

The effects of four parameters (pretreatment of adherend, curing cycle, time before testing, and humidity) on the strength of adhesively-bonded single lap joints were investigated for aluminium 2024-T3 adherend and modified epoxy FM73M adhesive. The importance of conditioning the aluminium surface prior to bonding was confirmed. Furthermore, the pretreatment needed to be attuned to the environmental conditions under which the joint was to be used. It was found that roughening the aluminium surface gave a poorer joint strength. Cooling joints in normal environmental conditions after the curing procedure gave satisfactory strengths if a relaxation period of 30 days was allowed before loading. The fitting of the experiments to a statistical distribution was examined to allow use of the experimental results for finite element techniques with probabilistic models. The same statistical behaviour as that for joints subjected to cyclic loading was found for joints subjected to humidity. 9 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE

Accession no.542778

Item 373

Adhasion Kleben & Dichten

38, No.5, 1994, p.10-7

German

PRIMERS NOT NEEDED

Rieder M

Gurit-Essex (Deutschland) GmbH

Since the mid-1980s it has been possible to use adhesives on the body of a car without first using a primer, thus saving time and expense. Comparative data on different adhesive systems is given.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.540864

Item 374

Adhasion Kleben & Dichten

37, No.11, 1993, p.22-5

German

NEW EPOXY ADHESIVE - NOT ONLY

SUITABLE FOR ELECTRONICS

Hussain A; Pflugbeil C
Compech GmbH

The tin-lead solder-resistant surfaces widely used in electronics are difficult to stick or coat with traditional adhesives. An epoxy adhesive modified with liquid rubber, HYCAR, has now been developed which has good adhesion to tin-lead surfaces due to its toughness and resilience. The adhesive has applications in the electronics industry where switches of tin-lead, polyimide, glass and ceramic materials must be stuck together without pre-treatment. 6 refs.

SIEMENS AG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE
Accession no.540843

Item 375

Adhasion Kleben & Dichten

37, No.11, 1993, p.16-21

German

ASPECTS OF ADHESION AND SEALING IN THE ELECTRONICS INDUSTRY

Heitz E

The uses of various adhesives and sealants in the electronics industry are described. Some examples are epoxy adhesives for mounting electrical components in automobile construction and silicone rubber used as a sealant for electrical cables.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE
Accession no.540842

Item 376

Adhasion Kleben & Dichten

37, No.7-8, 1993, p.34-5

German

NEW GENERATION OF REACTIVE BUTYL ADHESIVES

Keller H

Ford-Werke AG

Ford has worked closely with suppliers to bring about cost savings on new acquisitions, continuous production and post-production. A Terostat anti-flutter adhesive (underseal) was selected. The equipment used for application was specially adapted to the adhesive to achieve the high quality required.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY;
WESTERN EUROPE
Accession no.540823

Item 377

Journal of Adhesion Science and Technology

9, No.1, 1995, p.81-95

EFFECTIVENESS OF WATER-BORNE PRIMERS

FOR STRUCTURAL ADHESIVE BONDING OF ALUMINIUM AND ALUMINIUM-LITHIUM SURFACES

Meyler K L; Brescia J A

US,Army Armament Research,Develop.&
Engng.Center

Three commercially-available water-borne structural adhesive primers (two of which contained chromates) were evaluated for their effectiveness on both aluminium and aluminium-lithium alloy surfaces. The water-borne primers evaluated were American Cyanamid's BR 250 WBP and BR 250 WBP-NC and 3M's EC 3982. The study control was 3M's EC 3924B, a solvent-borne epoxy primer. Studies included shear strength evaluations for each primer system using 3M's AF-163-2K modified epoxy film adhesive at 24C and 104C for both metals, at -55C for aluminium-lithium and at 93C after 2 weeks exposure to a 93C/condensing humidity environment for aluminium samples. Wedge crack extension tests were performed for samples exposed to 60C and condensing humidity for 2 weeks. Floating roller peel studies were conducted on aluminium test samples only at -55, 24 and 104C. 17 refs.

AMERICAN CYANAMID CO.; 3M CO.
USA

Accession no.540728

Item 378

Adhesives Age

38, No.2, Feb.1995, p.50-6

JOINING OF DISSIMILAR MATERIALS THROUGH ADHESIVE BONDING

McCleary S F; Lambing C L T

Alcoa Technical Center

Some of the research conducted on adhesive bonding of steel to aluminium is reviewed, and the factors controlling adhesion, initial joint strength and bondline durability discussed. Tests on the wash resistance of adhesive systems in the uncured state and various properties of bulk specimens are described. Aspects described include adhesive selection, bulk adhesive properties test, adherend surface treatments, initial room temperature and elevated temperature lap shear testing, room temperature roller peel testing and durability and natural weathering testing. 7 refs.

USA

Accession no.540183

Item 379

Adhesives Age

38, No.1, Jan.1995, p.24-5

AVOIDING FIELD DELAMINATION WITH MOISTURE-CURE URETHANE

A case history is presented which describes the changeover from a solvent based adhesive to an environmentally compliant moisture curing urethane adhesive. The company, Coachmen Recreational Vehicle, converted to a new environmentally friendly, one-part,

100% solids, moisture curing urethane laminating adhesive from Pierce & Stevens for use on the laminated walls and ceilings panels of their recreational vehicles. Use of the adhesive eliminated delamination problems, reduced emission of VOCs, increased the vehicle's lifespan and helped to boost product sales.

COACHMEN RECREATIONAL VEHICLE CO.;
PIERCE & STEVENS CORP.
USA

Accession no.539678

Item 380

ICCM/9. Volume 4: Composites Design. Conference Proceedings.

Madrid, 12th-16th July 1993, p.74-81. 627

**MODE I FATIGUE TESTING OF ALUMINIUM/
EPOXY ADHESIVE BONDS**

Lowe A; Mai Y-W

Sydney, University

Edited by: Miravete A

(Zaragoza, University)

The mode I fatigue crack propagation rate in aluminium/rubber-modified epoxy bonds was studied as a function of applied stress intensity factor and bond thickness. An electronic crack monitoring system was developed to track crack growth. A modified Paris power law was developed to model the mode I fatigue crack growth behaviour over all bond thicknesses. The fatigue crack path was found to depend on bond thickness, whereas fatigue crack growth was generally less stable at smaller bond thicknesses. 18 refs.

AUSTRALIA

Accession no.538120

Item 381

ICCM/9. Volume 4: Composites Design. Conference Proceedings.

Madrid, 12th-16th July 1993, p.63-73. 627

**FATIGUE FROM WATERHAMMER ON
FILAMENT WOUND GRE-PIPES AND
ADHESIVE BONDED JOINTS**

Gustafson C G; Semb G; Moursund B

Norwegian Institute of Technology; Norsk Hydro AS

Edited by: Miravete A

(Zaragoza, University)

A new test method which simulates fatigue caused by water hammer in filament wound glass fibre-reinforced epoxy pipes and adhesive bonded pipe joints is described. The test programme indicated that the adhesive bonded coupler joint is weaker than the pipe itself. Results for the fatigue life are presented and the failure mechanisms are characterised by splitting the test specimens for closer investigation of the crack paths by microscopy. Acoustic emission measurements were carried out to study the initiation and propagation of cracks. 10 refs.

NORWAY; SCANDINAVIA; WESTERN EUROPE

Accession no.538119

Item 382

ICCM/9. Volume 4: Composites Design. Conference Proceedings.

Madrid, 12th-16th July 1993, p.36-46. 627

**CRITICAL DEFECTS IN ADHESIVE TUBULAR
JOINTS OF GRP PROCESS PIPES
DETERMINED WITH ACOUSTIC EMISSION**

Melve B; Moursund B

STATOIL Research Centre; Norsk Hydro Research Center

Edited by: Miravete A

(Zaragoza, University)

Double muff tubular adhesive joints with various defects were made from 100 mm diameter glass fibre-reinforced epoxy pipe. An epoxy adhesive was used. The pipes were pressurised up to 1.5 times the design pressure and were tested using acoustic emission. After the first loading, the pipes were unloaded and pressurised until failure. Acoustic emission identified the only failure which was a joint with 85% of the area without bonding. Stress analyses also showed that this defect is critical. An ordinary pressure test would not have identified this defect. 14 refs.

NORWAY; SCANDINAVIA; WESTERN EUROPE

Accession no.538116

Item 383

ICCM/9. Volume 4: Composites Design. Conference Proceedings.

Madrid, 12th-16th July 1993, p.15-19. 627

**BONDING STRUCTURAL COMPOSITES FOR
AIRCRAFT**

Krieger R B

American Cyanamid Co.

Edited by: Miravete A

(Zaragoza, University)

The use of adhesives in bonding structural composites for aircraft is reviewed. Adhesive bonding is used for composite to composite, composite to metal and in sandwich construction. In sandwich construction, adhesive is used co-cured with the composite face skins and for bonding precured face skins. There is a preponderance of carbon fibre composites in modern aircraft design. The reasons for this are discussed and bonded structures are described. Current problems with composite bonding, and suggested solutions to these, are examined. 1 ref.

USA

Accession no.538113

Item 384

European Adhesives & Sealants

11, No.4, Dec.1994, p.22/6

**ELECTRONIC COMPONENT SEALING USING
UV AND HEAT CURING ADHESIVES/
SEALANTS**

Sheehan J

Loctite International

Traditionally, electronic components such as relays or trimming potentiometers have been sealed with one- or two-component heat curing epoxy sealants. Problems encountered with one-component systems have been flow of uncured sealant inside the component during heat curing, and long cure cycles at elevated temperatures. Two-component systems have similar problems. New epoxy-based adhesive/sealants are now available which can be immobilised by UV light to prevent flow, then fully heat cured at moderate temperatures/time to give maximum strength/adhesion. Details are given.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.537084

Item 385

Adhesives Age

37, No.13, Dec.1994, p.20-3

ELECTRICAL SURFACE TREATMENT IMPROVES ADHESIVE BONDING

Blitshteyn M; McCarthy B C; Sapielak T E
Tantec Inc.; Bostik Inc.

Peel tests were carried out on adhesive bonds on PP substrates using polyamide and urethane hot melt adhesives. Due to their low surface energy and wettability, polypropylene requires surface treatment prior to adhesive bonding. The use is described of electrical discharge treatment to produce polar groups on the polymer surface to increase adhesive bond strength. 6 refs.

USA

Accession no.536114

Item 386

International Journal of Adhesion & Adhesives

14, No.4, Oct.1994, p.243-53

EFFECT OF FLUORINATION ON THE SURFACE CHARACTERISTICS AND ADHESIVE PROPERTIES OF POLYETHYLENE AND POLYPROPYLENE

Kranz G; Lueschen R; Gesang T; Schlett V;
Hennemann O D; Stohrer W D
Lohmann GmbH & Co.; Fraunhofer Institut;
Bremen,University

PE and PP were treated with fluorine/nitrogen or fluorine/oxygen/nitrogen mixtures at atmospheric pressure. Changes in surface chemistry and topography as well as depth of fluorination were examined using FTIR analysis, X-ray photoelectron spectroscopy, atomic force microscopy(AFM) and ellipsometry. Even very short exposure times caused a significant substitution of the hydrogen atoms by fluorine. No change in surface topography was noticed at magnifications of up to 5000 times by SEM, but AFM showed that fluorination led to an increase of microroughness. The influence of fluorine or fluorine/oxygen concentration, as well as time of

treatment and time of storage before adhesive bonding, on adhesion of PP to steel was investigated using a bending peel test. Significant improvement in peel strength was achieved with only minor fluorination intensity. Increase of fluorination intensity did not lead to further improvement in peel strength. Analysis of the fracture surfaces showed that the samples failed cohesively in the polymer or directly beneath the fluorinated layer. A model was proposed to describe the formation of specific interactions between substrate and adhesive. 29 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.532105

Item 387

Journal of Reinforced Plastics & Composites

13, No.9, Sept.1994, p.835-54

BOND STRENGTH OF FRP-WOOD INTERFACE

Barbero E; Davalos J; Munipalle U
West Virginia,University

Three potential wood/fibre-reinforced plastics (FRP) adhesives were selected for this study: (i) resorcinol-formaldehyde, which is a wood adhesive, (ii) emulsion isocyanate, which is essentially a crosslinked vinyl emulsion adhesive, and (iii) epoxy resin, a strong fibre-reinforced plastics adhesive. Performance of the selected adhesives is evaluated on small samples, under dry and wet conditions, following a modified ASTM D-905 test procedure. The objectives of this paper are to present a finite element stress analysis of the FRP-wood bond interface of yellow poplar/FRP shear-block samples under dry and wet conditions, and to describe the determination of material properties and model parameters needed in the finite element analysis. The model is correlated with experimental results of a qualification programme. A review of the experimental programme is presented to define the problem to be modelled numerically, and the results of the experimental programme are used to validate the numerical analysis. 20 refs.

USA

Accession no.529903

Item 388

Wilmington,De., 1994, pp.4. 12ins. 4/5/94. 6A1-8953

LUXTRAK SERIES 2000 - ADHESIVES FOR OPTOELECTRONICS AND FIBRE OPTICS

Zeneca Specialties

A product selector for the various grades of Luxtrak adhesives is presented, with details of grades, features and applications. Properties are also tabulated for grades in the Series 2000 which are designed for optoelectronics and fibre optics applications. The adhesives are curable by visible light.

USA

Accession no.525792

Item 389

Danbury, Ct., 1993, pp.4. 11ins. 3/5/94. 43E-6A1-8953
**UV CURABLE CLASS VI MEDICAL GRADE
ADHESIVE FOR IMPROVEMENTS IN
MEDICAL ASSEMBLY**
Electro-Lite Corp.

Properties and applications are detailed for 5 grades of Electro-Lite UV curing adhesives which are designed for use in medical device assembly. The adhesives are capable of bonding dissimilar substrates with close tolerance fits, and are available in a variety of viscosities from thin-wicking grades to thixotropic gels capable of gap filling.

USA
Accession no.525719

Item 390

Adhesives Age

37, No.9, Aug.1994, p.53

**FABRICATOR USES URETHANE ADHESIVE
FOR ASSEMBLY**

Precision Pattern Inc. is cutting costs and streamlining fabrication of aircraft interior components by using Uralane 5774-A/B PU adhesive on a variety of bonding and assembly projects. Applications of the adhesive by the company are described. The adhesive offers performance and versatility to produce different types of components with one adhesive. Because the adhesive is easy to use, employee training is minimised.

PRECISION PATTERN INC.
USA

Accession no.524897

Item 391

Rubber Products Manufacturing Technology.
New York, Marcel Dekker, 1994, p.449-72. 8
RUBBER-TO-METAL BONDING

Sexsmith F H
Lord Corp.

Edited by: Bhowmick A K; Hall M M; Benarey H A
(Indian Institute of Technology; Industrial Engineering Corp.)

The motor vehicle industry is by far the biggest user of bonded elastomer components. Typical applications such as engine mounts, suspension bushings, transmission and axle seals, couplings and body mounts are largely engineered to each vehicle's requirements. Manufacture usually involves moulding of the elastomer to shape, vulcanisation and bonding, all in a single stage operation. Aspects covered include rubber-to-metal assemblies, materials, manufacturing methods, adhesives and testing. 38 refs.

USA

Accession no.524806

Item 392

Antec '93. Conference Proceedings.
New Orleans, La., 9th-13th May 1993, Vol.III, p.2555-8. 012

**TENSILE AND IMPACT PERFORMANCE OF
MODIFIED POLYPROPYLENE/ALUMINIUM
LAMINATES**

Chinsirikul W; Karasek M L; Harrison I R
Pennsylvania, State University
(SPE)

Results are presented of a study of the tensile and impact properties of oriented PP/aluminium laminates bonded with a propylene-hexenol copolymer (PPH). Both bond strength and PP orientation played a significant role in determining the mechanical properties of the laminates. With maximum adhesion, the highest properties were obtained only when oriented PP was used and the test direction was parallel to the draw direction. Laminates bonded with PPH showed an appreciable increase in adhesion and superior mechanical properties compared with acid etched samples. 10 refs.

USA

Accession no.524657

Item 393

Machine Design

66, No.13, 11th July 1994, p.22-3

**JOINING METHODS CLEAR HURDLE FOR
ALUMINIUM-AND-STEEL CARS**

Novel joining methods for dissimilar metals such as steel and aluminium used in automotive applications, are described. The first involves the use of Versilok two part epoxy resin which eliminates the need for heat induction and welding, both processes leading to problems of dimensional stability through warping and distortion, and enables car makers to reduce weight in the use of aluminium parts, and reduce labour costs by the elimination of two manufacturing steps.

USA

Accession no.524015

Item 394

Euradh '92. Conference Proceedings.
Karlsruhe, Germany, 21th-24th Sept.1992, p.304-8. 6A1
**APPLICATION OF ADHESIVE BONDING TO
SHAFT JOINTS**

Ikegami K; Kyogoku H; Sugibayashi T
Tokyo, Institute of Technology
(Dechema Institut; Adhocom; Deutsche Verband fur Schweisstechnik)

A method for connecting metal shafts by adhesive bonding is proposed. Two metal shafts with the same diameter are adhesively connected by metal coupling with epoxy resin. The material of the shaft is carbon steel and the couplings are aluminium alloy and brass. The strength of the shaft joint under tensile or torsional loads is investigated

analytically and experimentally. The stress and strain distributions of the shaft joint are analysed by using the finite element method. The analysed strain distributions in the joint are compared with the experimentally measured values. The joint strength is evaluated by applying the strength laws of adherends, adhesive interface and adhesive resin to the stress distributions of the corresponding parts. The evaluated failure loads of the joint are compared with the experimental values. The calculated joint strength predicts the initial failure load of the joint well. 1 ref.

JAPAN

Accession no.522344

Item 395

Lawrenceville, N.J., 1994, pp.6, 11ins. 3/5/94. 6E47-8(10)1

ADVANCED ADHESIVE MATERIALS FOR ELECTRONIC, MICROELECTRONIC AND SEMICONDUCTOR ASSEMBLY

AI Technology Inc.

Details are given of advanced adhesive materials for use in electronic, microelectronic and semiconductor assemblies. The products supply high thermal transfer rates and provide flexible, low stress bonds. Applications are described in which they are used as component attach adhesives, solder replacement adhesives, low-strength interface materials, and die attach adhesives.

USA

Accession no.521843

Item 396

Journal of the Adhesive and Sealant Council. Volume XXIV, No.2, Spring 1994. Conference proceedings. Washington, DC, 27th-30th March 1994, p.107-29. 6A1

DURABILITY OF ADHESIVELY BONDED SYSTEMS

Dillard J; Wolfe K; Risch S; Mendenhall T; Cromer S Virginia, Tech (Adhesive & Sealant Council)

The durability of adhesively-bonded metals was studied in an attempt to gain a better understanding of the chemical factors influencing durability. Metal surfaces were chemically treated to give acid, base or neutral surfaces. The metals were then bonded in a wedge-type geometry and the stressed specimens were exposed to selected environmental conditions. Crack growth was monitored and the time to failure and failure rate and mode were shown to be influenced by the chemical nature of the surface treatment and that for the adhesive as well as by the gaseous atmosphere in which the experiments were carried out. Results for bonding of aluminium and titanium with polyimides and other adhesives are discussed. 4 refs.

USA

Accession no.515722

Item 397

Adhasion Kleben & Dichten

37, No.6, 1993, p.17-22

German

PUR ADHESIVE SYSTEMS FOR PANEL MOUNTING IN CAR CONSTRUCTION

Rieder M

Gurit-Essex GmbH

Between 85 and 90% of vehicles in current production have directly glued panels. Materials based on PU have a combination of high strength with relatively high elasticity and good ageing resistance. The properties and methods of use of three types of PUR systems are described. Ecological and safety factors are considered.

GENERAL MOTORS CORP.

EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE

Accession no.511883

Item 398

Adhasion Kleben & Dichten

38, No.3, March 1994, p.29

German

SAFETY IN THE ADHESION OF MOUNTED PARTS

Two new adhesive systems based on PU are suitable for joining plastics, composites and paints, e.g. to secure spoilers on cars. The two systems, Betamix K1 and K2, are designed for application by hand. They have been investigated by the Association for Technical Inspection (TUV) under a wide range of conditions.

GURIT-ESSEX AG

EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE

Accession no.511867

Item 399

Adhasion Kleben & Dichten

38, No.3, March 1994, p.13-6

German

GLUED COMPONENTS FROM THE CONSTRUCTION POINT OF VIEW

Friedrich M; Koetting G

Audi AG

Suggestions are made for a practical and application-oriented way of determining the mechanical properties of adhesives (following DIN 54451). These are needed to optimise weight and stress loading in glued constructions in the automotive industry. Details are given of laboratory tests. e.g. shear-stress measurement, carried out on car body components. 11 refs.

EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE

Accession no.511862

Item 400

Adhasion Kleben & Dichten

37, No.9, 1993, p.39-42

German

LONG-TERM PERFORMANCE OF GLUED PLASTIC-METAL JOINTS

Dorn L; Salem N

Berlin, Technical University

Deformation in the adhesive film of plastic-metal joints subjected to long-term stress increases in proportion to stress level. Uneven and unsymmetrical deformation along the overlap is more marked with increased stressing. Plastic-metal joints should therefore be designed so that microcracks occur in the adhesive film when stressed. 6 refs.

EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE

Accession no.511855

Item 401

International Journal of Adhesion & Adhesives

14, No.1, Jan.1994, p.21-30

ADHEREND SURFACE MORPHOLOGY AND ITS INFLUENCE ON THE PEEL STRENGTH OF ADHESIVE JOINTS BONDED WITH MODIFIED PHENOLIC AND EPOXY STRUCTURAL ADHESIVES

Sargent J P

British Aerospace

A detailed investigation of the interfacial region between the oxide and the adhesive/primer for aluminium peel test specimens, bonded with Redux 775 and AF 163-2K/EC3960 and covering a range of peel strengths was undertaken. TEM and SEM showed that increasing adherend roughness on scales of tens of micrometres and tens of nanometres correlates with increasing peel strength. Measurements of carbon, aluminium and oxygen on both sides of the fracture surface for in-situ peeled AF 163-2K specimens was made using X-ray photoelectron spectroscopy. This corroborated the TEM morphological evidence that enhanced peel strengths arise because of the presence of very fine scale whisker-like features at the surface of the oxide. Theoretical calculations are also presented which demonstrate one mechanism whereby roughness on a scale of tens of micrometres could give rise to enhanced peel strength. 5 refs.

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.510646

Item 402

Adhasion Kleben & Dichten

37, No.3, 1993, p.16-8

German

ADHESION AND SEALING IN MACHINE BUILDING

Billeter M

Klebchemie M.G.,Becker GmbH & Co.KG

Anaerobic products are available as adhesives for joints and sealants for interlocking and stress-free joints, e.g. dimethacrylate. They have excellent properties, e.g. wide viscosity range, good temperature resistance, resistance to oil, solvents, etc. The use of anaerobic adhesives in machine building eliminates the need for many small but important steps in the work process. This has already been recognised by the automotive industry. 4 refs.

EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE

Accession no.509400

Item 403

Adhasion Kleben & Dichten

37, No.10, 1993, p.32-4

German

ADHESION PROBLEMS AND THE ELECTROCHEMICAL STRESS SERIES

Bauer A; Bischof C

Fraunhofer-Einrichtung fuer Ang.Polymerforschung

The possible relationship between the electrical potential of a metal surface and the strength of metal/polymer composites is discussed. With increasing negative or positive electrochemical potential the strength of the composite increases in relation to the functionality of the adhesive. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE

Accession no.509392

Item 404

Machine Design

66, No.5, 7th March 1994, p.156

CONCURRENT ENGINEERING BRINGS NEW FACES TO AEROSPACE DEVELOPMENT TEAMS

The collaboration between BP Chemicals and Boeing is discussed with reference to the choice of adhesives to solve specific problems on components on the Boeing 747 and 777 aircraft. Epoxy based adhesives are used to edge-fill and fill seams on a metal-composite landing gear assembly, and Araldite AV 138/HV 998 adhesive is used to bond titanium pivots to composite thrust reverser doors. Design features of the components and the performance required of the adhesive are discussed.

BP CHEMICALS CO.,ADVANCED MATERIALS DIV.; BOEING CO.

USA

Accession no.508183

Item 405

Adhesives Age

37, No.3, March 1994, p.34

SYSTEMS SEAL EDGES AND BOND COMPONENTS IN AIRCRAFT APPLICATIONS

The use is described of two adhesive and sealant products which are used by Beech Aircraft Corp. The products are

Epocast 87005-a/be-60, a syntactic sealant for edge filling metal honeycomb panels on the plane's ventral fin, and Uralane 5776-A/B, a urethane adhesive used to assemble the cabin window frames and headliners. Design details are described of Beech 1900D and the King Air B200 aircraft, and the ways in which the use of these adhesive products facilitate assembly and improve design and performance.

BEECH AIRCRAFT CORP.
USA

Accession no.507814

Item 406

Journal of Adhesion Science and Technology

8, No.2, 1994, p.101-15

FATIGUE LIFETIME ASSESSMENT OF ADHESIVE JOINTS BY ULTRASONIC AND THERMAL WAVE IMAGING

Aglan H
Tuskegee, University

Damage by flexural fatigue ageing of fabricated adhesively bonded specimens was induced at different intervals of their fatigue lifetime. The research specimens were similar to those used in actual aircraft production in the 1970s, except that rivets were not included. Non-destructive evaluation (NDE) (ultrasonic and thermal wave) inspection was performed in an attempt to correlate the NDE parameters with the fatigue lifetime of the adhesively-bonded specimens. The specimen geometry was a modification of the double cantilever beam to permit slow cleavage-type debonding. Moreover, the geometry and loading configuration provided a simple testing programme, with very simple analytical methods to determine the energy release rate at the tip of the debonded surfaces. 22 refs.

USA

Accession no.504584

Item 407

Journal of Applied Polymer Science

51, No.7, 14th Feb.1994, p.1199-206

PREPARATION AND CHARACTERISATION OF CRYOGENIC ADHESIVES. I. GLYCIDYL-TERMINATED POLYURETHANE RESINS

Der-Shyang Chen; Chen-Chi M Ma; Hung-Chung Hsia; Wang-Nang Wang; Shiaw-Ruey Lin
China Technical Consultants Inc.; Taiwan, National Tsing Hua University; Taiwan, Chung Shan Institute of Science & Technol.

Glycidol reacted with isocyanate-terminated PU to form glycidyl-terminated PU resins. A series of glycidyl-terminated PUs, based on polytetramethylene ether glycol, polypropylene glycol and polyester soft-segments, having different molecular weights were synthesised and their adhesion properties (tensile shear strength) on aluminium were evaluated. The effect of soft-segment structure, soft-segment length, and temperature on adhesion were examined. The resins showed superior adhesion at

cryogenic temperatures. The results coincided with transitions shown by dynamic mechanical spectroscopy and morphology shown by SEM. The modified systems showed advantages in storage stability and room-temp. curing over commercial PU adhesives.

TAIWAN

Accession no.503922

Item 408

Polyurethanes World Congress 1993. Conference Proceedings.

Vancouver, B.C., 10th-13th Oct.1993, p.327-31. 43C6

NOVEL REACTIVE ONE COMPONENT SYSTEM WITH NO FREE ISOCYANATE GROUPS FOR ADHESIVES

Hirayama S; Hashimoto S; Hidai T
INOAC Corp.

(SPI, Polyurethane Div.; SPI Canada Inc.; European Isocyanate Producers Assn.)

New reactive polymers contain isocyanate dimer (uretdion) units and no free isocyanate groups. Isocyanate is released on heating. Crosslinking takes place without emission of volatiles. Their performance as adhesives is compared with conventional polyurethane adhesives from environmental and bonding aspects. Data on adhesion of Inorethane DH adhesives to aluminium are shown, although other substrates (stainless steel, wood and PETP) are mentioned. 17 refs

JAPAN

Accession no.502775

Item 409

Adhesives Age

36, No.13, Dec.1993, p.31

STRUCTURAL ADHESIVES SIMPLIFY MANUFACTURE OF COMPOSITE SAILBOATS

Advance USA, Connecticut, has created a hybrid-composite construction system for the use of thermoplastic composites in boat construction. The article supplies comprehensive details of the simplified manufacture of thermoplastic composite sailboats using structural adhesives.

ADVANCE USA; ITW ADHESIVE SYSTEMS; JY SAILBOATS

USA

Accession no.501693

Item 410

European Adhesives & Sealants

10, No.4, Dec. 1993, p.13/6

ULTRAVIOLET CURABLE ADHESIVE APPLICATIONS ON THE LIQUID CRYSTAL DISPLAY

Dooley J M

Loctite (Ireland) Ltd.

The popularity of liquid crystal displays are reported to have been rising rapidly. This is proved by the wide

number of applications now using the technology. These include watches and calculators, personal computer display, TV screen, camera/clocks, measuring instrument readouts and automotive display panels. Aspects covered include LCD side sealing or gasketing, charge port sealing, metal pin terminal bonding and terminal sealing for active matrix LCD. 4 refs.

EIRE

Accession no.501317

Item 411

Advanced Composites Letters

2, No.4, 1993, p.131-4

**FATIGUE DAMAGE OF COMPOSITE/
COMPOSITE ADHESIVELY BONDED JOINTS**

Roy A; Gacougnolle J L; Petit J; Gamby D
ENSMA

An investigation was made of the fatigue damage of lap joints consisting of glass fibre-reinforced unsaturated polyester plates bonded with an epoxy resin structural adhesive. The results showed that the damage consisted of a main crack appearing in a stress concentration zone in the adherends which then grew in the laminate first layer in a mixed mode propagation stage to the final stage leading to ultimate failure. 6 refs.

EUROPEAN COMMUNITY; FRANCE; WESTERN EUROPE

Accession no.501089

Item 412

ICCM/9. Volume 2: Ceramic Matrix Composites and Other Systems. Conference Proceedings.

Madrid, 12th-16th July 1993, p.387-90. 627

**ROLE OF METAL SURFACE PROPERTIES IN
ADHESION INTERACTION WITH
POLYOLEFINS IN COMPOSITE MATERIALS**

Malers L; Sirmacs A
Riga, Technical University
Edited by: Miravete A
(Zaragoza, University)

A study was made of failure modes in adhesive joints prepared by bonding metal foils subjected to different surface preparation techniques using HDPE and EVA as adhesives. 7 refs.

EUROPEAN COMMUNITY; LATVIA; SPAIN; WESTERN EUROPE

Accession no.499240

Item 413

Adhesion '93. Conference Proceedings.

York, 6th-8th Sept.1993, p.181-6. 9(12)4

**METHOD FOR THE DIRECT MEASUREMENT
OF THE MECHANICAL PROPERTIES OF
ANODIC OXIDES WITHIN ALUMINIUM
ADHESIVE JOINTS AND THEIR INFLUENCE
ON DURABILITY PERFORMANCE**

Davies R J; Ritchie M; Moth D; Bowditch M
Rialtech Ltd.; UK, Defence Research Agency
(Institute of Materials)

This paper describes the development of experimental methods and mathematical analyses for the direct measurement of the mechanical properties of thin anodic oxides produced on aluminium alloys. Measurements in the change in mechanical properties of the oxide layer due to the creation of a micro-composite interphase (consisting of a porous anodic oxide and adhesive) are shown. The effects of water ingress on the mechanical properties of these micro-composites are described and the influence of these property changes on the durability performance of an adhesive joint is explored. 13 refs.

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.499045

Item 414

Adhesion '93. Conference Proceedings.

York, 6th-8th Sept.1993, p.86-94. 9(12)4

**AUTOMOTIVE HOTMELT BODY SHOP
ADHESIVES/SEALANTS**

Jud K; Zaugg F
EMS-TOGO AG
(Institute of Materials)

A new solution for hemflange sealing in the automotive industry has been created, which is more cost-effective, environmentally more acceptable and better performing in hostile environments. Low melting, high melt flowing and high sag resisting EVA-rubber hot melts were developed for durable adhesion on oily steels. The excellent heat resistance, the electrocoatability and high environmental resistance are some of the performance benefits and the ecological acceptance of olefinic base resins is obvious. However, the main goal was met with the application improvement, hemflange sealing in the body shop without pregelation is feasible by robotic application at acceptable extrusion temperatures. No additional costs arise for conditioning or any other treatment.

SWITZERLAND; WESTERN EUROPE

Accession no.499032

Item 415

Journal of Adhesion Science and Technology

7, No.11, 1993, p.1183-94

**EVALUATION OF PRIMERS FOR ADHESIVELY-
BONDED AIRCRAFT REPAIR**

Chabot K A; Brescia J A
US, Army Armament Research, Develop. &
Engng. Center

An investigation is presented for determining the effectiveness of primers in promoting adhesion and improving the environmental durability of epoxy resin adhesive bonds on grit-blasted aluminium substrates. Studies include shear strength evaluations. 12 refs.

USA

Accession no.498114

Item 416

SAMPE Journal

29, No.6, Nov/Dec.1993, p.8/12

**ADHESIVE BONDED STRUCTURAL REPAIR.
III. REPAIR OF COMPOSITE, HONEYCOMB
CORED, AND SOLID CORED STRUCTURES**

Wegman R F; Tullos T R
Adhesion Associates

Details are given of standardised repair technology for laminate, and composite or metal faced sandwich structures. The use of two-part room temperature curing paste adhesives or structural film adhesives is discussed.

USA

Accession no.498074

Item 417

Journal of Materials Science

28, No.22, 15th No.1993, p.6205-10

**EFFECT OF FILLERS ON THE DEGRADATION
OF AUTOMOTIVE EPOXY ADHESIVES IN
AQUEOUS SOLUTIONS. II. THE
MICROHARDNESS AND DELAMINATION OF
AUTOMOTIVE EPOXY ADHESIVES IN
DISTILLED WATER AND SODIUM CHLORIDE
SOLUTIONS**

Tai R C L; Szklarska-Smialowska Z
Ohio,State University

The effect of water and sodium chloride solutions on four different automotive epoxy adhesives bonded on electrodeposited zinc-iron steel substrate were investigated as a function of the degree of microhardness change in the adhesives under water and sodium chloride solution immersion tests. On the basis of the microhardness measurements, it was found that the soft and elastic adhesives were more susceptible to adhesive softening, swelling and microdamage than the hard and brittle adhesives upon exposure to the test solutions. The degree of microhardness decrease in the adhesives increased with the concentration of the sodium chloride solution. In the presence of sodium chloride, the same degree of microhardness decrease was obtained in the adhesives although less water was absorbed from the sodium chloride solution than from the distilled water. In addition, delamination of the adhesives from the steel substrate was observed after each microhardness measurement. Oxygen played an important role in the process of adhesive delamination, although it had no effect on the change in the microhardness of the adhesives. 22 refs.

USA

Accession no.497864

Item 418

Structural Adhesives in Engineering III. Conference Proceedings.

Bristol, 30th June-2nd July 1992, p.30/1-30/7. 6A1

**USE OF ADHESIVE BONDING FOR THE
ATTACHMENT OF STIFFENERS**

McGrath G C

TWI

(PRI,Adhesives Group)

Stiffeners were attached to metal plates by adhesive bonding. Adhesives with different moduli and the geometry of the stiffener were investigated under the fatigue loading of an aluminium/zinc/magnesium alloy and steel adherends. Interactions between joint geometry, adhesive modulus and failure mode showed the importance of correct joint design. 3 refs.

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.494593

Item 419

Structural Adhesives in Engineering III. Conference Proceedings.

Bristol, 30th June-2nd July 1992, p.15/1-15/4. 6A1

**NEW METHOD TO SURFACE PREPARE
POLYETHYLENE FOR ADHESIVE BONDING**

Doyle D J

GMI Engineering & Management Institute

(PRI,Adhesives Group)

The use of an excimer laser, emitting 248 nm light (KrF), is presented as a technique for surface preparation of PE for adhesive bonding. Enhanced lap-shear bond strengths were found when HDPE was excimer-laser treated and bonded using a cyanoacrylate adhesive.

USA

Accession no.494578

Item 420

International Polymer Science and Technology

20, No.5, 1993, p.T/77-80

**MODIFICATION OF ADHESIVE PROPERTIES
OF ISOTACTIC POLYPROPYLENE**

Novak I; Pollak V

Various surface modification techniques for improving the adhesion properties of isotactic PP were investigated. It was found that in order to improve the hydrophilicity and free surface energy by modification with UV radiation, 1 to 2 minutes of action was sufficient, depending on the distance of the radiation surface (50 or 100 mm) from the surface of the polymer. With the combined action of phosphorus trichloride, the effect of UV radiation on the polymer surface increased, free surface energy increased by 29% (in comparison with the unmodified polymer) and the mechanical work of adhesion increased six fold with respect to the original value. The use of the powerful oxidising agents potassium permanganate and ammonium peroxodisulphate resulted

in increases in free surface energy of 16% and 19%. 4 refs. (Full translation of *Plasty a Kaucuk*, No.11-12, 1992, p.172)

CZECHOSLOVAKIA; EASTERN EUROPE

Accession no.491899

Item 421

SAMPE Journal

29, No.4, July/Aug.1993, p.8-13

ADHESIVE BONDED STRUCTURAL REPAIR. I. MATERIALS AND PROCESSES, DAMAGE ASSESSMENT AND REPAIR

Wegman R F; Tullos T R

Adhesion Associates

Guidelines are presented for the repair of adhesive bonded composites and sandwich structures. Aspects of damage assessment, materials selection, materials storage and handling, safety and quality assurance are discussed.

USA

Accession no.486083

Item 422

Journal of Thermoplastic Composite Materials

6, No.1, Jan.1993, p.18-28

ADHESION IMPROVEMENT IN POLYPROPYLENE/ALUMINIUM LAMINATES

Chinsirikul W; Chung T C; Harrison I R

Pennsylvania,University

Laminates were prepared by bonding oriented PP sheets to aluminium foil treated with a propylene-hexenol copolymer. These laminates showed a 7 to 10-fold increase in peel strength over acid etched samples. Chemical interaction between the oxide/hydroxide layer on the etched aluminium and reactive sites in the copolymer, together with mechanical interlocking due to polymer flow into pits on the aluminium surfaces, were prominent factors in achieving maximum adhesion. Cohesive failure was the primary failure mode in peeled samples. 19 refs.

USA

Accession no.486071

Item 423

Journal of Adhesion

40, Nos.2-4, 1993, p.81-91

PRIMERS FOR BONDING POLYOLEFIN SUBSTRATES WITH ALKYL CYANOACRYLATE ADHESIVE

Okamoto Y; Klemarczyk P T

Loctite Corp.

Details are given of a study of primers for promoting adhesion on PE and PP with cyanoacrylate adhesives. 4 refs.

USA

Accession no.485668

Item 424

Aerospace Materials

5, No.1, May-July 1993, p.13-7

WEATHERING THE STORM

Marsh G

The activities are described of Ciba-Geigy in the field of composites and adhesives technology for the aerospace industry. Product diversity is seen as one factor which has enabled the company to weather the present economic recession.

CIBA-GEIGY (UK) LTD., BONDED STRUCTURES DIV.; CIBA COMPOSITES

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.481229

Item 425

Plasty a Kaucuk

30, No.3, 1993, p.80-2

Slovak

EFFECT OF BULK GRAFTING ON ADHESIVE PROPERTIES OF ISOTACTIC POLYPROPYLENE

Novak I; Pollak V

Slovak Academy of Sciences

The authors studied the adhesive properties of isotactic polypropylene grafted with itaconic acid. The free surface energy of the modified polypropylene was found to increase significantly with increase in the concentration of bound itaconic acid. An increase was observed in the mechanical work and equilibrium work of adhesion of the modified polypropylene. 6 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

SLOVAKIA

Accession no.480658

Item 426

Polymer

34, No.9, 1993, p.1981-3

IMPROVED ADHESIVE PROPERTIES OF HIGH-MODULUS PE STRUCTURES: II. CORONA GRAFTING OF ACRYLIC ACID

Mercx F P M

TNO Plastics & Rubber Research Institute

High-modulus PE tapes were grafted with acrylic acid using a two-step procedure. The tapes were first subjected to helium/argon corona discharge, immediately followed by exposure of the corona-treated tapes to acrylic acid saturated helium gas. Evidence for the grafting was provided by X-ray photoelectron spectroscopy. The effect of corona grafting on both the adhesion to epoxy resin and the mechanical properties is discussed. 21 refs.

EUROPEAN COMMUNITY; NETHERLANDS; WESTERN EUROPE

Accession no.480581

Item 427

Adhesives Age

36, No.5, May 1993, p.40-1

COMPOSITE BONDING COVERED IN DEPTH AT SPRING MEETING

Bowtell M

Information is presented in some detail on papers given at a one-day symposium which took place at the Society of the Chemical Industry in London during early March 1993. Organised by the British Institute of Materials' Adhesives Group, the symposium was titled 'Bonding of Advanced Composites'. Topics discussed included use of adhesives to bond fibre composites, modified bismaleimide adhesives for bonding high temperature structural carbon composites, patch repair of aramid fibre reinforced laminates, repair of structural composites, and bonding techniques with particular reinforced metal matrix composites.

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.480389

Item 428

Advanced Composites

8, No.2, March/April 1993, p.47

EVALUATING ADHESIVES FOR SANDWICH CONSTRUCTION

This article outlines factors to be considered when evaluating adhesives for sandwich structures. In order to achieve a good attachment to an open-cell core such as honeycomb, the adhesive must have a unique combination of surface-wetting and controlled flow during early stages of cure. Scrim cloth can be added to the adhesive to prevent the close-fitting surfaces from squeezing out all the adhesive. Toughness and peel strength are also discussed, and a list of common adhesives for sandwich construction is presented.

HEXCEL CORP.

USA

Accession no.479879

Item 429

International Journal of Adhesion & Adhesives

13, No.2, April 1993, p.97-104

DURABILITY OF BONDED COATED STEEL JOINTS

Davis R E; Fay P A

Ford Motor Co.

Results are presented of the first three years of an investigation into the durability of bonded coated steel joints under tropical conditions. Three different steels are being evaluated, bonded with three epoxy adhesives, and the joints are being exposed with and without imposed stress. The uncoated mild steel joints exhibited poor durability. The retained strength of unstressed joints declined rapidly as the extent of bondline corrosion

increased. Failure times of stressed joints were rapid and also due to bondline corrosion, except when a more flexible adhesive was used, failure then being due to creep of the adhesive. The durability of electrogalvanised and zinc-nickel coated steel joints was generally much better, the retained strengths were higher and the failure times of stressed joints were usually longer. This was mainly attributed to the absence of bondline corrosion. It was found, however, that coating failure sometimes occurred with the zinc-nickel coated steel when bonded with the stiffer adhesives. This affected both the initial strength and the durability of joints, although the degree of coating failure appeared to be reduced as exposure time increased. 10 refs.

EUROPEAN COMMUNITY; UK; WESTERN EUROPE

Accession no.477857

Item 430

Journal of Materials Science Letters

12, No.8, 15th April 1993, p.612-4

MODIFICATION OF POLYPROPYLENE BY PEROXIDE-GRAFTING OF MALEIC ANHYDRIDE FOR ADHESIVE BONDING: SURFACE AND INTERFACE

Lin C W

China Steel Corp.

The modification of PP by dicumyl peroxide-catalysed grafting of maleic anhydride was studied and the effect of the amount of maleic anhydride on the adhesion to a steel surface was investigated. The effect of hydrolysis of the surface of maleic anhydride on the bondability of the modified PP was examined. The failure loci of the PP-g-maleic anhydride/steel adhesive joint were determined. 5 refs.

TAIWAN

Accession no.477764

Item 431

Journal of Applied Polymer Science

48, No.2, 10th April 1993, p.359-70

PRIMERS FOR ADHESIVE BONDING TO POLYOLEFINS

Yang J; Garton A

Connecticut,University

When PP and LDPE were coated with about 100 nm of triphenylphosphine or cobalt acetylacetonate primers, adhesive bonds could be made using ethyl cyanoacrylate(CA) adhesive. These bonds were shown to be sufficiently strong so that the bond strength exceeded the bulk shear strength of the polyolefin and were sufficiently durable to withstand immersion in boiling water for long periods of time. The dependence of adhesive bond performance on primer thickness, application solvent, ageing of primed surface and the bond durability were explained on the basis of a model in which the primer dissolved in the polymer surface and facilitated

interpenetration of the polyolefin and the monomeric CA. The primer catalysed cure of the CA, resulting in entanglement of adhesive and adherend chains. The model was tested using IR spectroscopic, X-ray spectroscopic and SEM analyses. 15 refs.

USA

Accession no.474623

Item 432

Composites & Adhesives Newsletter

9, No.2, Jan-March 1993, p.9

NASA-LANGLEY IS HONOURED FOR POLYIMIDES

NASA-Langley Research Center has received the International R & D 100 Award for the development of LaRC-RP46, a family of ultra-high performance thermosetting polyimide polymers for use in advanced composites and adhesives. This comprehensive article supplies details of the properties and manufacture of the material.

NASA LANGLEY RESEARCH CENTER; SP SYSTEMS

USA

Accession no.473572

Item 433

Polymer

34, No.4, 1993, p.856-65

SYNTHESIS AND PROPERTIES OF POLY(ARYLENE ETHER BENZIMIDAZOLE)S

Hergenrother P M; Smith J G; Connell J W

US, NASA Langley Research Center

Poly(arylene ether benzimidazole)s were prepared by the aromatic nucleophilic displacement reaction of three new bis (4-hydroxyphenyl)benzimidazole compounds with activated aromatic difluoro compounds. Tg's were 264 to 352C and inherent viscosities from 0.79 to 1.99 dl/g. Tensile properties at elevated temperatures were measured for films. Controlled molec. wt. samples were used to fabricate prepregs and laminates which had excellent retention of flexural and compressive properties at 232C. Adhesion tests of glass fibre adhesive tape to titanium after ageing at 200C were also performed. 35 refs. (Presented at ACS Symp.on Advances in Polymeric Matrix Composites, San Francisco, USA, 5th-10th April 1992).

USA

Accession no.471184

Item 434

Journal of Materials Science

28, No.3, 1st Feb. 1993, p.753-9

IMPROVED ADHESION PROPERTIES OF HIGH-MODULUS PE STRUCTURES. I. OXIDATIVE ACID ETCHING

Mercx F P M; Benzina A; Van Langeveld A D; Lemstra P J

TNO Plastics & Rubber Research Institute; Eindhoven, University of Technology

Details are given as to whether acid treatment could improve the adhesion of oriented PE structures to epoxy resins in relation to the chemical composition of the surface and the surface topography. 25 refs.

EUROPEAN COMMUNITY; NETHERLANDS; WESTERN EUROPE

Accession no.469058

Item 435

Journal of Applied Polymer Science

44, No.6, 25th Feb. 1992, p.993-1001

HYDROPHILIC AND ADHESIVE PROPERTIES OF METHACRYLIC ACID-GRAFTED PE PLATES

Yamada K; Kimura T; Tsutaya H; Hirata M

NIHON, UNIVERSITY

Methacrylic acid was grafted onto PE surfaces by simultaneous irradiation with UV rays in the liquid phase and the hydrophilic properties and adhesive properties of the resulting copolymers evaluated. Hydrophilic properties were determined from contact angle and swelling measurements as a function of the grafted amount. The grafted PE surfaces were analysed using ESCA in order to relate the hydrophilic properties with surface composition. Adhesive properties were determined by tensile shear adhesive strength measurements. 21 refs.

JAPAN

Accession no.447593

Item 436

How Concept Becomes Reality. Book 1. Symposium Proceedings.

San Diego, Ca., 15th-18th April 1991, p.372-82. 012

STRUCTURAL ANALYSIS OF ADHESIVELY BONDED JOINTS OF TUBULAR GEOMETRY

Arah C O; McNamara D K; Hand H M; Mecklenburg M F; Dasgupta A; Hornbeck B K

MARTIN MARIETTA LABORATORIES

Edited by: Stinson J; Adsit R; Gordaninejad F

(Sampe)

Stress distribution was studied in an adhesively bonded tubular joint and an attempt was made to optimise its configuration by minimising the normal and shear stresses on the joints. Prototype joints bonded with a toughened adhesive were made and their stress distributions measured under experimental loadings. The adherend surfaces were phosphoric acid anodised to induce failure either in the adhesive or in the aluminium tube away from the joint, rather than at the interface. Adhesive and adherend stress distributions in the joint overlap were determined by linear, three-dimensional and non-linear axisymmetric finite element analysis. 4 refs.

USA

Accession no.432637

Item 437

Journal of Adhesion

34,Nos.1-4,1991,p.137-51

STRESS ANALYSIS OF ADHESIVE BUTT JOINTS OF DISSIMILAR MATERIALS SUBJECTED TO CLEAVAGE LOADS

Nakano Y;Temma K;Sawa T

KISARAZU,NATIONAL COLLEGE OF TECHNOLOGY; SHONAN,INSTITUTE OF TECHNOLOGY; YAMANASHI,UNIVERSITY

The results are reported of an experimental and theoretical study of stress distributions and displacements of an adhesive butt joint subjected to cleavage loads in which two thin plates made of dissimilar materials are joined. General representations of the stress and displacement fields are given using the two-dimensional theory of elasticity. Experiments were carried out on adherends of carbon steel, aluminium alloy and brass bonded with an epoxy resin adhesive (Scotch-Weld 1838B/A). 18 refs.

JAPAN

Accession no.424184

Item 438

New York, Marcel Dekker Inc., 1986, pp.xi,340. LS.51.

9ins. 6/12/88. 6A1

MACHINERY ADHESIVES FOR LOCKING, RETAINING, AND SEALING

Haviland G S

LOCTITE CORP.

This book is a detailed guide to the selection and use of anaerobic machinery adhesives effectively. Much of the data is empirical, derived scientifically in the laboratory. Where theoretical and analytical approaches help in understanding and designing, they are given. Data are assembled in tables and graphs for ready reference.

USA

Accession no.365923

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