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## Contents Lists and Abstracts from the Journal of the Adhesion Society of Japan

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# Contents Lists and Abstracts from the Journal of the Adhesion Society of Japan

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### **Dynamic Viscoelastic Properties of Cured Epoxy Resin for Adhesive**

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(Accepted for publication: January 11, 1994)

### **Abstract**

The dynamic viscoelastic properties of epoxy adhesive was investigated by using a transmission method of strain wave. Impact compressive load was applied to epoxy adhesive bar. The transmission of the strain wave generated by the impact load was measured. The velocity and the damping decrement of the strain wave were obtained by using frequency analysis of the strain wave. The complex compliance of the adhesive was

calculated from the velocity and the damping decrement. The real part of complex compliance decreases and the imaginary part increases with increasing the frequency.

(Received: November 11, 1993)

### **The Influence of Critical Surface Tension of Adherends on the Rolling Friction Coefficient and Peel Strength of Pressure Sensitive Adhesives**

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(Accepted for publication: February 16, 1994)

### **Abstract**

Practical performance of pressure sensitive adhesives depend not only upon the rheological properties, but also upon the surface chemical properties of the materials. In this study, the influence of the critical surface tension of the adherends upon the rolling friction coefficient and peel strength of both an acrylic pressure sensitive adhesive and a natural rubber based pressure sensitive adhesive.

In the velocity region where the interfacial failure occurs in case of the acrylic pressure sensitive adhesive, the values of the rolling friction coefficient and those of the peel strength have a positive correlation with the critical surface tension of the adherends, which means the fact that both the rate of the bonding process and the failure criterion concerning the interfacial failure are closely related to the critical surface tension of the adherend. Performances of the natural rubber based pressure sensitive adhesive were rather more complicated than those of the acrylic pressure sensitive adhesive. It is necessary to clarify the degree of solubility among the components and also the phase structures when we treat the pressure sensitive adhesives of blended system.

Rate dependence of the rolling friction coefficient is quite different from that of the peel strength, especially in the high velocity region, which must be attributed to the fact that the former involves both bonding and debonding processes, while the latter involves only the debonding process.

(Received: December 14, 1993)

### **Adhesive Strength of Oriental Lacquer Film Coated on Various Adherends**

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(Accepted for publication: January 10, 1994)

### **Abstract**

This paper is concerned with the adhesive strength of oriental lacquer film coated on various adherends. The adhesive strengths between the film and adherends were determined, when the test pieces were exposed

to various humidities. We used steel, brass, aluminum and wood as the adherend. In the case of steel and brass, adhesive strengths decreased as the humidity was deviated from 70% RH. In other words, the adhesive strength became maximum at 70% RH and in steel the maximum strength was 6.5 MPa. However, in aluminum the adhesive strength increased with humidity. Wood was similar in the behaviour of adhesive strength to steel, but the adhesive strength between wood and oriental lacquer film is from a quarter to a half as large as that between steel and the film. Concerning the elongation at break in tensile test, woods in adherends were different from steel and brass.

(Received: December 1, 1993)

**On Influences of Interface Corner Angle on the Thermal Stress in Adhesive Butt Joints**

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 (Accepted for publication: February 16, 1994)

**Abstract**

In most adhesively bonded joints, thermal properties between an adhesive and adherends are generally quite different, therefore thermal stress is generated under a temperature change in the bonding area. The thermal stress has large effects upon the strength and the reliability of the joints. In this paper, thermal stresses of an adhesive butt joint are studied when the adherends are made of aluminum plates and one component epoxide resin and heat setting type adhesive is used. When the corner angles of an adherend are set at 90, 60, 45 and 30 degrees, the thermal stress distributions at the interfaces are analyzed by using two-dimensional finite element method (FEM). The adhesive layer is modeled by an epoxide resin plate and the adhesive butt joints are manufactured for photoelastic experiments. The isochromatic fringe patterns obtained by photoelastic experiments are consistent with the analytical results obtained by FEM. From the analysis and the experiments, it is shown that the thermal stress decreases near the edge of the interface as the corner angle decreases from 90 to 30 degrees. Therefore, it is predicted that joint strength is improved when the corner angle is decreased.

(Received: January 18, 1994)

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**Modification of Cylinder Tack Test for Measuring the Rolling Friction Coefficient  
of Pressure Sensitive Adhesives against Various Kind of Adherends**

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(Accepted for publication: February 16, 1994)

**Abstract**

In order to measure the rolling friction coefficient (or tack) of a pressure sensitive adhesive on various adherends by means of the cylinder tack test (CT test), we need the cylinder. But it is sometimes difficult either technically or economically to mould the materials into cylinders. In this study, we have developed a modified cylinder tack (MCT) test, where a pressure sensitive adhesive layer is transferred onto the surface of a metal cylinder, and then the cylinder is pulled on a flat surface of various adherends. It is shown that we can easily measure the rolling friction coefficient of pressure sensitive adhesives on any adherend by means of this MCT test. Then, we tried to measure the rolling friction coefficient of an acrylic pressure sensitive adhesive on a series of silicone release agents, and clarified how the peel controlling agent influences the tack of the materials.

(Received: December 8, 1993)

**The Interfacial Adhesion Strength and the Permeation of Water Through the Interface  
for the Epoxy Resin System with Some Foreign Matter Inserted**

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(Accepted for publication: March 28, 1994)

**Abstract**

When foreign matter was inserted into the epoxy matrix, its apparent bonding strength depended on both the ordinary adhesion strength of the matrix and the strangling pressure generated with the contraction of matrix. It was tried in former report to evaluate these two facts separately.

In this report, the relations between the water permeation through the interface or the retention rate of the bonding strength and the ordinary adhesion strength were discussed for the cured epoxy resins which have the same apparent adhesion strength. The water permeation was depressed with an increase in the ordinary adhesion strength. And, the retention rate was increased in proportion to the ordinary adhesion strength.

Therefore, the durability was improved not with an increase in the apparent adhesion strength but with an increase in the ordinary adhesion strength.

(Received: March 7, 1994)

**Properties of Fluorinated Epoxy Resin, Diglycidylether of Bisphenol AF**

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 (Accepted for publication: April 18, 1994)

**Abstract**

The properties of bisphenol AF epoxy resin (DGEBAF). 2,2-bis (4-glycidylphenylether) hexafluoropropane, were studied. Its surface tension and refractive index were lower than those of conventional bisphenol A (DGEBA) epoxy resin due to the lower dipole moment of trifluoromethyl groups. It provides better wettability to adherends and makes the refractive index of formulation controllable. The glass transition temperature of polyamide cured DGEBAF is higher than that of DGEBA, which suggests that the DGEBAF system should have rigid chains. By controlling the curing agent content, cured resins with low elastic modulus and high glass transition temperature were obtained. And the heat resistance and the flexibility of cured resins were simultaneously improved. Not only the initial, but also the immersed tensile shear strength in the DGEBAF system were higher than the DGEBA system.

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This was a special issue in which neither the Contents List nor the Abstracts were in English.

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(Accepted for publication: June 24, 1994)

**Abstract**

This study is concerned with the bonding strength of coated film on steel balls. Normal stress generated at the interface between the film and the balls was obtained by simulation, when the film was exposed to an atmosphere at given temperatures. The normal stress increased with temperature, and was more considerable at temperatures above 60°C. The stress at 100°C reached five times as much as that at 60°C, and the stress increased with the decrease of radius of the ball. These results mean that the edge of the lacquer ware is more fragile than flat surface.

(Received: May 11, 1994)

**Effect of Curing Temperature on the Cohesive Strength of Modified Silicone-Epoxy Resin System**

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(Accepted for publication: June 30, 1994)

**Abstract**

In order to understand the curing temperature dependence of the cohesive strength of modified silicone-epoxy resin system, modified resins were prepared at some different curing temperatures over 20°C and 80°C.

Cohesive strengths, dynamic mechanical properties, and morphologies of the cured resins were investigated. The cohesive strength of the modified epoxy resin system was enhanced with increasing curing temperature.

This result was explained by a decrease in the diameter of dispersed epoxy phase, i.e. an increase in the interfacial area between matrix and dispersed phase. The increase of the interfacial area led to the improvement of lap joint and T-peel strength.

(Received: May 11, 1994)

**Dependency of Adhesion of Photoresist Micro Pattern on Thermal Stress Distribution**

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(Accepted for publication: June 20, 1994)

**Abstract**

The correlation between the thermal stress and the adhesion behavior of photoresist was studied. The thermal stress distributed along with the planar shape of the resist pattern. Compressive and tensile stresses were especially concentrated at the inner and the outer corners, respectively. It is found that the side-etching of the thermal oxide substrate has a close relationship to these stress concentrations.

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