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

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### Graft Modification of Chloroprene Rubber with Poly (Methyl Methacrylate) Macromonomers

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## Abstract

The graft modification of chloroprene rubber with poly (methyl methacrylate) macromonomers was investigated. The degree of grafting increased with increasing radical initiator concentration and

reaction time. The graft product having the higher degree of grafting couldn't be prepared because of the occurrence of gelation in the graft reaction at high radical initiator concentration. The molecular weight of graft chain was the same as that of macromonomers used. Therefore, it was confirmed that the molecular weight and number of graft chain were controlled by the molecular weight and grafting amount of macromonomers. Peel strength for the bonding to plasticized poly (vinyl chloride) sheet reached its maximum value, at which the molecular weight and number of graft chain were 6000–10400 and 0.5–0.8, respectively. Thus, it is concluded that the peel strength is dependent on the molecular weight and number of graft chain.

(Received: December 16, 1988)

### Wood Bonding by Hot Melt Adhesives on The Edge Banding of Wood-Furniture by Using of Hot Melt Adhesives

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#### Abstract

Operating conditions of the edge banding machine were determined by evaluating bonding strength. The results are as follows:

- 1) On the operation of the edge banding machine, the speed of feed at 20 m/min was superior to that at 15 m/min.
- 2) Suitable temperature of hot melt adhesives for the banding machine was about 180°C.
- 3) The pressure of compressed air for pressure-roller at 6 kgf/cm<sup>2</sup> was superior to that at 4 kgf/cm<sup>2</sup>.
- 4) Thinning thickness of adhesives or using hot melt adhesives with high melting point prevented bonding strength from reduced.

(Received: December 5, 1988)

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**Effects of some factors on the increase in strength by combining adhesive bonding with rivet fastening**

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**Abstract**

The effects of some factors on the increase in strength obtained by combining adhesive bonding with rivet fastening are investigated. Factors examined were the measuring temperature, the lap length, the number of rivets, the position of rivets and the ratio (R/B) of strength of rivet fastened joints (R) to that of adhesive bonded joints (B).

The results are as follows:

- (1) The increase in strength is remarkably affected by the difference of the measuring temperatures. As the measuring temperature rises, the increase in strength gets larger. It seems that the increase in strength depends on Young's modulus of the adhesive, and that it is larger in the case of lower modulus.
- (2) The increase in strength has a tendency to get larger in the case of the lap length is shorter or the number of rivets is larger.
- (3) Fastening the rivets near the center of the lap area is more effective on the increase in strength than fastening them near the end of it.
- (4) When R/B is large, the increase in strength gets larger. When R/B is above 1, the strength of rivet-adhesive combined joints is larger than that of adhesive bonded joints. However, when R/B is less than about 0.3, the increase in strength does not take place. When R/B is among 0.3 ~ 1, sometimes the strength increases or decreases.
- (5) In this study, the maximum value of the ratio (RB/B) of the strength of the rivet-adhesive combined joints (RB) to that of the adhesive bonded joints (B) was 2.2 and the maximum value of the increase in strength was 7.45 kgf. In the least effective case, the strength of the combined joint decreased 13% (300 kgf) of that of the adhesive bonded joints.

Received: January 20, 1989

**Fracturing Behavior of Single Lap Joints using Galvanized Steels  
Part 1. Factors of Fracturing Behavior**

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**Abstract**

Because galvanized steels damage electrode tips during spot welding, adhesive bonding is the method of choice. However, adhesive joints using galvanized steels tend to fail at the plating-steel interface, and this plating fracture is unfavorable because after failure the stripped steel will suffer from corrosion.

In order to find a way to avoid plating fracture, single lap joints of galvanized steels were tested at various temperatures and crosshead speeds. We found that the fracturing behavior of these joints was governed by the plating adhesion to steel and the viscoelasticity of the adhesives. Therefore, there are two possible ways to avoid plating fracture; improving plating adhesion, and selecting adhesives in terms of viscoelasticity.

(Received: January 30, 1989)

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**Three-Dimensional Elastic Analysis of Adhesive Bonded Joints by Boundary Element Method**

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**Abstract**

The computer program for three-dimensional analysis of adhesive bonded joint by boundary element method has been prepared. The scale of numerical analyses is reduced by this program. In this program, a linear element which has four nodes at each apex is used. Generally numerical integration is evaluated within 32 integral degrees of Legendre-Gauss Formula. The integral scheme by means of subdivision element is adapted in case of the evaluations of singular integral or nearly singular integral in which concerns adhesive layer. By these methods, the computer C.P.U. time is reduced.

Three-dimensional stress-strain analyses of bonded block, single lap joint, and weldbonded joint by this program were computed. The results were compared with analytic solution or Two-dimensional

analyses by Boundary Element Method. It is found that satisfactory numerical accuracy was acquired by large surface element division and application of Boundary Element Method to adhesive bonded joint is simple and useful.

(Received: December 26, 1988)

**Fracturing Behavior of Single Lap Joints using Galvanized Steels  
Part 2. Effect of Viscoelastic Properties of Adhesives**

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**Abstract**

The adhesive joints of galvanized steels tend to fail at the plating-steel interface, and this failure mode is unfavourable from a corrosion-protection point of view. In the previous paper, we found that the fracturing behavior of single lap joints using galvanized steels was governed by the viscoelastic property of adhesives. To describe quantitatively the relation between adhesive properties and joint performance, we tried, in this paper, to correlate the fracturing behavior of these joints with the mechanical properties of adhesive films.

It was found that Young's modulus  $E$  and storage modulus  $E'$  of adhesive film, which were tested under the same conditions as the corresponding joints, can be correlated to the fracturing behavior of the joints, and that it is necessary for adhesives not to exceed the critical values of  $E$  and  $E'$ , described below, to avoid plating fracture of the joints.

$$E < 1220 \text{ (MPa)}$$

$$E' < 1280 \text{ (MPa)}$$

Upon considering these numerical criteria, we can say that the best adhesives for galvanized steels are those that show an almost constant value of Young's modulus which is just below the critical value over a wide range of temperatures.

(Received: February 1, 1989)

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**The Cross-linking of Thermoplastic Polyesters Utilizing a Metal-complex**

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**Abstract**

The adhesion of polyethyleneterephthalate film at high temperatures is improved by utilising, as an adhesive, a mixture of thermoplastic copolyester and a metal complex.

Failure of adhesion at high temperature results in the cohesive failure of the adhesive, and the enhancement of cohesive energy in the adhesive is attributed to the cross-linking of the copolyester chain effected by the metal ion.

The carboxyl end-groups of the copolyester are more effective compared to the hydroxyl end-groups in the cross-linking with a metal ion.

The effective metal complexes for the cross-linking reaction are those which are comprised of chelating agents with a lower basicity such as 8-hydroxyquinoline or acetylacetone.

Effective metal ions for the cross-linking reaction are those which have seven or eight electrons in the outer orbital and those which have a higher positive charge.

(Received: November 26, 1988)

**Effects of Some Factors on the Aberration of the Optical Mirror Caused by Adhesive Bonding**

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**Abstract**

We investigated the effects of some factors on the aberration of the optical mirrors caused by adhesive bonding. The optical glass mirror is a rightangled isosceles triangular prism in shape. The mirror was bonded to the aluminum base by adhesives and the aberration on an inclined plane on the mirror was measured by an interferometer. The factors examined were the kind of adhesives, the curing condition of adhesives, the measuring part on an inclined plane and the shape of the bases. The

results were as follows:

- (1) It seems that the aberration caused by adhesive bonding depends on both the coefficient of volume contraction in curing of adhesive and the Young's modulus after curing, and that it is larger in the case of larger contraction and higher modulus.
- (2) In the case of epoxy adhesives, as the curing temperature rises, the aberration gets larger.
- (3) In the case of UV curing adhesives, as the intensity of UV irradiation gets stronger and the temperature of the specimen is raised by UV irradiation, the aberration gets larger.
- (4) It seems that the aberration depends on the thickness of the glass, and that it is larger in the case of the thinner glass.
- (5) The aberration is remarkably dependent on the shapes of the bases.

(Received: January 23, 1989)

### **Electro-conductive Glue Line by Metalized Carrier**

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### **Abstract**

In order to give the conductivity to glue line between adherends, using the carrier which was metalized by the electroless plating method instead of the adhesive containing conductive filler was investigated.

Conductivity of the carrier depended on amount of nickel which was deposited reductively on it, and its conductivity became higher with the increase of metal content on carrier.

The conductivity of glue line between adherends by using metalized carrier decreased, but the degree of decrease in conductivity was not much more than the performance of metalized carrier itself.

When the metalized carrier was used in the glue line between adherends, the drop of the adhesive strength was observed. However, its strength was higher than the strength of adhesive containing conductive filler. These results suggested that this adhesive technique could be useful to obtain the high-strength bond on conductive adhesive.

(Received: June 15, 1989)