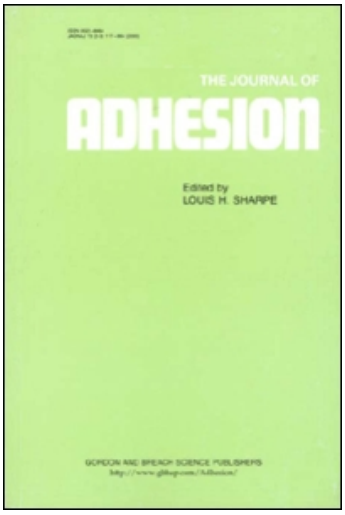

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Contents

A Role of Solubility Parameter (SP) in Solubility Theories Part II. Developments of Some Solubility Theories

Toshinao OKITSU

Urawa Laboratory Konishi Co., Ltd.
(5-3-35, Nishibori, Urawa-shi Saitama 338, Japan)

(Accepted for publication: November 25, 1992)

Abstract

Theories of solubility have been developed originally by Hildebrand (1936), Flory–Huggins (1941) and then by Blanks–Prausnitz (1964) and Hansen (1967), but these theories were not accurate in the case of the solvents and the polymers with hydrogen bonding. Recently, Huyskens (1985) introduced a unique theory and provided the hydrogen bonding parameters. His theory coincided relatively with experimental data, but it contained some complex unknown parameters. The author will report a relatively more accurate equation with simple and few parameters in this paper.

(Received: September 19, 1992)

Study on Corrosion of Magnet Optical Disk Reflection Film in Reference to the Characteristics of UV-Light Curing Resin Protective Coating Applied Over the Film

Minoru KAWASAKI

Victor Company of Japan, Ltd.
RINKAN PLANT 1612-1, Shimoturuma,
Yamato-shi, Kanagawa 242, Japan

(Accepted for publication: December 18, 1992)

Abstract

The relationship between the magnet optical disk reflective film corrosivity and the following three characteristics of UV-light curing resin film, which was applied to the reflection film, were investigated:

- Water absorption
- Water vapor transmission rate
- Electrical conductivity in extrapure water

Defect and byte error rate were studied and inspected using a scanning acoustic microscope to determine this relationship.

The results indicated greater corrosion on the aluminum reflective film than on the aluminum reflective film with 3% titanium. Both were treated with UV-light curing resin film. Water absorption and water vapor transmission did not cause the corrosion. Reflective film corrosion is related to extrapure water material electrical conductivity. However, UV-light curing resin film has a low electrical conductivity in extrapure water. Therefore, UV-light curing resin film is not corroded. Only while there was high electrical conductivity did corrosion result.

Inspection using a scanning acoustic microscope showed that magnetic optical disk corrosion of UV-light resin film, recording film, and polycarbonate resin substrate arises from each layer of the material itself.

The above-described method of measuring electrical conductivity of material in extrapure water enables the detection of small quantities of electrolytic material elution. Therefore, this method is an effective means to assess the material corrosivity.

(Received: August 31, 1992)

Surface Modification of Wood by Photo-oxygenation and Its Effect on Adhesive Properties

Keisuke SHIMIZU, Akira KOJIMA and Satoru KIMURA

Gunma College of Technology
(Toriba-cho, Maebashi-shi, Gunma 371, Japan)

Kenji KARASAWA

Gunmaken Industrial Research Laboratory
(Toriba-cho, Maebashi-shi, Gunma 371, Japan)

Takao YOSHIKAWA

Railway Technical Research Institute
(Hikari-cho, Kokubunji-shi, Tokyo 185, Japan)

(Accepted for publication: March 1, 1993)

Abstract

In order to improve bonding durability and reliability of glued wooden products, the surface of lauan was modified into a hydrophilic state by employing one of the new dry surface modification methods called "photo-oxygenation treatment" featuring the use of ultra-violet light and ozone gas.

The effect of this treatment on wettability and bond strength were examined and the following results were obtained. That contact angle of water on the lauan surface decreased from 100° to 5°, and the penetration of water increased after treatment. The adhesive bond of lauan pretreated with photo-oxygenation exhibited 1.4 times higher shear strength than that of untreated lauan.

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Study of Acrylic Adhesive Surface Behavior by FTIR-ATR (Part 1)

Masayoshi KAWABE

Nitto Denko co., Ltd.
(18 Hirayama, Nakahara-cho, Toyohashi-city 441-31, Japan)

(Accepted for publication: January 14, 1993)

Abstract

Studies related to the surface and physical properties of the adhesive is essential for its development.

However, so far the available surface and interface evaluation technology has not been developed enough.

Recently, a new surface and interface evaluation technology by FTIR-ATR applied to an acrylic model polymer with many carboxyl groups, followed with an increase of the contact area and peak shifts

for 14 days, resulted in successful detection of the carbonyl group peak shifts. Carboxyl and ester groups were found and shifted for low and high wavenumbers, respectively. This result suggests the change of molecular interaction of the adhesive for the substrate.

(Received: October 1, 1992)

Fracture Toughness of Adhesive Interface for Mixed Modes and Interfacial Strength of Single Lap Joints

Daiki KAMIYA, Chiaki SATO and Kozo IKEGAMI

Precision and Intelligence Laboratory,
Tokyo Institute of Technology
(4259, Nagatsuta, Midori-ku, Yokohama 227, Japan)

(Accepted for publication: December 17, 1992)

Abstract

Fracture toughness of adhesive interface was experimentally investigated for mixed modes by cylindrical butt joints with cracks in the adhesive interface. The fracture criterion for mixed modes was determined by using the experimental result. The strength of single lap joints with cracks at both ends of adhesive interfaces was estimated by the criterion. The stress distribution of the lap joint under the tensile load was analyzed by the finite element method. The stress condition at the adhesive edges produced the fracture with mixed modes by the tensile and torsional stress components. The fracture load of the joint was calculated by the experimentally determined fracture criterion for mixed modes. The calculated results approximately coincided with the experimental joint strength.

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A Two-Dimensional Stress Analysis and Strength Evaluation of Adhesive Butt Joints of Dissimilar Adherends to Tensile Loads

Katsuhiro TEMMA

Kisarazu National College of Technology
(2-11-1, Kiyomidai-higashi, Kisarazu, Chiba, 292)

Toshiyuki SAWA

Department of Mechanical System, Yamanashi University
(4-3-11,Takeda, Koufu, Yamanashi, 400)

Hiroaki ISHIKAWA

Mitsubishi Heavy Industry Co. Ltd.
(5007, Itozakicyo, Mihara, Hiroshima, 729-03)

Tohru NISHIGAYA

Shizuoka Prefecture Police Institute of Scientific Research Institute of Criminal Investigation
(9-6, Oitecyo, Shizuoka, 420)

(Accepted for publication: November 19,1992)

Abstract

The stress of adhesive butt joints are analyzed as a three-body contact problem, using a two-dimensional theory of elasticity in order to establish the fracture criteria when the joints of dissimilar adherends are subjected to tensile loads. In the analysis, the dissimilar adherends and the adhesive are replaced with finite strips, respectively. In the numerical calculations, the effects of the ratio of the Young's modulus of adherends to that of the adhesives, and the thickness of the adhesives, the load distributions on the stress distributions at the interfaces were demonstrated. In addition, with use of the stress distribution, a method for evaluating the joint strength was proposed. For verification, experiments were performed on the strains of adherends and the joint strength. The analytical results were consistent with the experimental ones.

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Creep Rupture of Ultrasonic Welding for Plastics

Hiroyuki ISHII

Industrial Research Institute of Saitama
(3-10-1, Kizaki, Urawa, Saitama, 338 Japan)

(Accepted for publication: November 21, 1992)

Abstract

The purpose of this article is to investigate the effect of creep rupture characteristics of ultrasonic welding for POM and ABS resin under air, silicone oil and water. The temperatures of the creep rupture tests are from 20 to 100°C.

The results obtained are as follows:

1) The creep rupture of ultrasonic welding for POM and ABS resin is inferior to POM and ABS resin itself. The creep rupture characteristics of ultrasonic welding has fallen in the order of air, silicone oil and water.
2) The empirical formula for the creep rupture strength of the ultrasonic welding for POM and ABS resin or POM and ABS resin itself is presented in the following, as shown in former paper[1,2]

$$\sigma_c = (\sigma_{coo} - n_1\tau) - (m_{co} - n_2\tau)\log\ t_c$$

where σ_c is creep rupture strength at t_c hr, σ_{coo} is the creep rupture strength under 20°C at rupture time of 1 hr loading, m_{co} is the amount of stress change per $\log_{10}(10t_c - 1t_c)$, n_1 and n_2 are constants, τ is the temperature (°C) and t_c is creep rupture time. The value of n_1 ranges are from 2.6 to 3.6, and n_2 is from -0.2 to 0.5.
3) The creep rupture of POM and ABS resin itself, ultrasonic welding for POM and ABS resin is applicable to a coefficient formula of Larson-Miller under POM from 20 to 100°C, ABS resin is from 20 to 60°C.

1) H. Ishii, Y. Yamaguchi; *Journal of The Adhesion Society of Japan,* **15,** 7, 1 (1979)
2) H. Ishii, E. Matumura, Y. Yamaguchi; *Journal of The Adhesion Society of Japan,* **23,** 1, 13 (1987)

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The Adhesion Society of Japan may be contacted at: Koa Nipponbashi 203, 4-2-20, Nipponbashi, Naniwa-ku, Osaka 556, Japan.