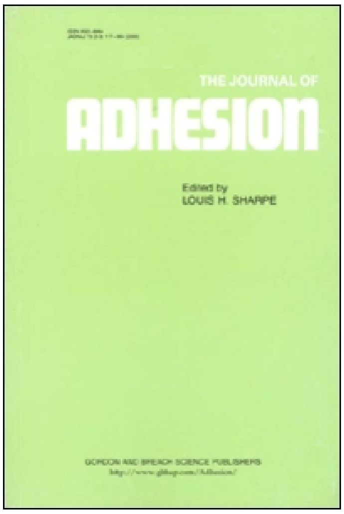

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Study of Polymer Blend as a Vibration Damper

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Abstract

Metallic materials have too small internal friction to damp vibration making noise, whereas plastics show remarkably large damping capacity in some characteristic temperature ranges where a considerable part of the vibrational energy is consumed as a result of molecular friction.

If the two kinds of materials are combined, one can expect that the vibration of the composite materials will be damped to a greater extent than that of the metal itself.

In this study dynamic mechanical properties of a variety of polymer blends were measured and those which have a broad E″ peak around 0°C were chosen from among them.

Sandwich structures of Al/polymer/Al type were then constructed and the dynamic mechanical properties of the composite systems were measured by means of a vibration reed technique. It was found that the sandwich structures with these polymer blends had larger damping capacity than that with poly (vinyl acetate) or Al itself.

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The Methods of Measuring Tackiness of the Pressure Sensitive Adhesive Tapes.

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Abstract

The tackiness of pressure sensitive adhesive tapes has been studied with various methods by many investigators; however, the tackiness value obtained for identical adhesive tapes by various measuring methods is different. Tackiness was often evaluated by the finger test. As the finger test contains very complex factors, it is very important to analyze the result of the finger test but it is difficult.

The present authors measured the tackiness of some pressure sensitive adhesive tapes by various methods. The rolling-ball tack tester, ball tack tester, self-pressure tack tester, probe tack tester and finger tester were used for measuring the tackiness of some commercial pressure sensitive adhesive tapes; namely, cloth, cellophane, polyester film and non-plasticized poly (vinyl chloride) film pressure sensitive adhesive tapes. When the results obtained were compared with the finger test, rolling-ball tack obtained by the rolling ball tacktester with a sine curve surface (curve expressed by the following equation; $y = 86.7 \cos (\pi/300 \times \chi) + 86.7$ was close to the results of the finger test.

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Studies on Rheology of Pressure Sensitive Adhesive Tapes

5. Theoretical equation for 180° angle peel force at constant peel rate

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Abstract

A popular method for measuring the peel force of pressure sensitive adhesive tape is the 180° angle peel test, but the theoretical analysis of the value obtained is not obvious as yet.

An object of this study is to establish a theoretical peel formulation for understanding the measured value of peel force. The theoretical equation is derived from the following equation:

$$PVt = (W_a + W_d)\, b \cdot Vt$$

where b is the tape width. This equation is based upon the following balance.

Since the work done during peeling can be regarded as a force acting through a distance, PVt (V; peel rate, t; peel time Vt; distance) can be equated to the work of adhesion, W_a, plus for work of deformation in the adhesive layer, W_d.

Applying the simple Maxwell equation to the work of deformation in the adhesive layer, and carrying out the necessary calculation with some reasonable approximations, the following theoretical formulation for the peel force can be obtained.

$$P = AP^{1/2}V\left(e^{-\frac{B}{VP^{1/4}}} + \frac{B}{VP} - 1\right) + C$$

$$A = \frac{bf_c\eta^2}{2 \cdot 3^{1/2}(E_sI_s)^{1/2}E_a^2}$$

$$B = \frac{3^{1/4}t_a^{1/2}E_a^{1/2}(E_sI_s)^{1/4}f_c^{1/2}}{\eta}$$

$$C = \frac{b}{2}W_a$$

Where f_c critical surface adhesion
E_a; Young's modulus of adhesive mass
η; viscosity of adhesive mass
E_s; Young's modulus of backing
I_s; moment of inertia of backing
t_a; thickness of adhesive layer

This equation represents well the s-type curve of log P vs log V and indicates that the value of peel force is strongly dependent on work of deformation in the adhesive layer.

By series expansion of the exponential part of this equation and neglect of higher order terms, several useful equations are obtained.

In the range of high peel rate the peel force is expressed as follows:

$$P = \frac{bt_af_c^2}{4E_a} + \frac{b}{2}W_a$$

This equation is the same as Kaelble's 180° angle peel equation $P = bt_a\sigma_0^2/4E_a$ (where σ_0 is boundary stress) which is derived from stress distribution analysis.

The theoretical significance of the experimental results relating to the dependence of the peel force on temperature, and the effect of thickness and the width of pressure sensitive adhesive mass is well understood from this equation.

In the range of low peel rate, the following equation is given:

$$P - ABP^{1/4}V + AP^{1/2}V^2 = C$$

It is a very interesting coincidence that this equation is exactly the same as Hata's peel formula.

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