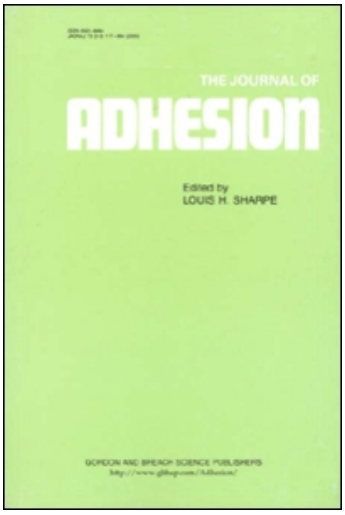

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On the Zisman Plot and the Critical Surface Tension

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Abstract

The Zisman plot and the critical surface tension (γ_c) were discussed by the interaction parameters ϕ and a being defined in the previous paper. The following have been shown.

(a) The Zisman plot, *viz.*, cosine of the contact angle θ ($\cos\theta$) *versus* the surface tension of homologous liquids (γ_L) is essentially curvilinear relationship.

(b) The γ_c can be theoretically formulated using the surface tension of solid (γ_s) and the polarity of liquid and solid. The γ_c determined by the extrapolation is supposedly smaller than or equal to the theoretical γ_c.

(c) A plot of $\ln(1+\cos\theta)$ *versus* $\ln\gamma_L$ is good enough for an alternative to the Zisman plot, and has a capability to give a reasonable γ_c being close to the theoretical one.

(d) The γ_s can be represented by an equation: $\gamma_s \approx \phi_x^{2(2a-1)}\gamma_c$ with the γ_c determined by using homologous liquids, the Kaelble-Uy's bonding efficiency parameter ϕ_x, and the interaction parameter a.

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On Energy Balance in Separating Interfacial Surfaces of Adhesive Joint*

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Abstract

As a result of thermodynamical investigation on the mechanical work done Γ_∞ to separate unit area of the interfacial surface of the adhesive joint, it is shown that Γ_∞ can be expressed by the work of adhesion W_a and the dissipated energy ψ in the interfacial surface as follows.

$$\Gamma_\infty = W_a + \psi - T(\partial W_a/\partial T)_A$$

T: absolute temperature, A: area of adhesion

Therefore the energy balance in the homogeneous adhesive system V can be expressed in a steady state as follows, using the result in the previous work.

$$P_v = \int_v \sigma^{ji}\dot{\varepsilon}_{ij}dV + \dot{a}[W_a + \psi - T(\partial W_a/\partial T)_A] + K + U$$

here, P: load, v: test speed, $\dot{a}$: separation speed, σ^{ji}: stress tensor, $\dot{\varepsilon}_{ij}$: strain rate tensor, K: kinetic energy, U: potential energy

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Generalization of Griffith's Criterion in Adhesive Fracture*

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Abstract

Generalized Griffith's criterion is derived by defining the mechanical energy release rate of the adhesive system consisted of materials which have any constitutive equation.

The following conclusions are drawn from the formulation.

(1) Griffith's condition is a necessary condition for fracture, but not a sufficient condition.

(2) The sufficient condition for the onset of fracture is the fracture criterion of strength of materials.

(3) Griffith's condition has physical meaning only for the system in advancing debonding process.

(4) If the mechanical energy release rate is used, Griffith's theory is valid for any materials and it is consistent with the fracture criterion of strength of materials.

(5) The fracture toughness by the conventional methods of fracture mechanics is the mechanical energy which includes the work of deformation in the process region and it is different from surface energy in surface chemistry.

(6) The phenomena such as peeling force decreases immediately after the onset of detachment and the slip-stick phenomenon can be explained by balance of Griffith's condition with the fracture criterion of strength of materials.

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Adsorption Properties of Hydrous Titanium Oxide Granules Prepared by Use of the Poly Acrylate Ester Emulsion

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Abstract

Hydrous titanium oxide granules were prepared by use of poly acrylate ester emulsion as a binder. Physical properties such as compressive strength, water absorption and surface area and adsorption property of phosphate ion were measured for the granules. The apparent porosity, water absorption, specific surface area and total micro pore volume of granules decreased by addition of polyacrylate ester emulsion, but strength of granules increased. The exchange capacity for phosphate ion was

* A Study of Mechanics of Adhesion (IV).

about 1 $mmolg^{-1}$ of hydrous titanium oxide granules. Exchange capacity did not decrease by the addition of poly acrylate ester emulsion in the hydrous titanium oxide. A granules type exchanger can easily be used for column operation.

Keywords: Binder; poly acrylate ester; hydrous TiO_2 granules; adsorption; phosphate.

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