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S/037/61/049/000/004/011
B102/B104

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TITLE: Determination of the total surface energy of solids from the angle of wetting

SOURCE: Kishinev. Universitet. Uchenyye zapiski. v. 49, 1961, 54-58

TEXT: The great deviations in surface energy as established by the usual methods are ascribed to the fact that most of those methods depend on solid - solid interaction. Here it is proposed to work with solid - liquid interaction for determining surface energy and stress. As compared with other wetting method., this one offers the advantage that the final formulas involve no quantities difficult to determine. The parameters of the liquid are assumed to be all known. Surface energies, σ, and wetting angle, θ, are related by $\sigma_1 - \sigma_{12} = \sigma_2(1 + \frac{1}{\cos\theta} - \tan\theta)$ where σ_{12} is a function of the potential energy of molecular interaction; the subscripts 1 and 2 refer to solid and liquid, respectively. When σ_{12} is calculated

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and expressed in terms of θ and $x = (v_2/v_1)^{1/3}$ this leads to the final relation

$$\sigma_1 = \frac{\sigma_2}{\left[\sqrt{1 + \frac{\pi x^3}{\left(\frac{1}{2} + \frac{x}{2}\right)^3 \left(2 + \frac{1}{\cos\theta} - \tan\theta\right)}} - 1\right]^2}. \qquad (13)$$

the v_1 are the specific volumes. Surface energy and surface stress are computed for solid benzene and for sulfur wetted with benzene, CCl_4, toluene, and cyclohexane. The values agree well with each other. The surface stress for NaCl is found to be 257 dyne/cm. There is 1 table.

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