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Influence of acrylic adhesive viscosity and surface roughness on the properties of adhesive joint

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Abstract— In adhesion, the wetting process depends on three fundamental factors: the surface topography of the adherend, the viscosity of the adhesive, and the surface energy of both.
The aim of this paper is to study the influence of viscosity and surface roughness on the wetting and their effect on the bond strength. For this purpose, an acrylic adhesive with different viscosities was synthesized and some properties, such as viscosity and surface tension, were studied before adhesive curing took place. Furthermore, the contact angle and the lap-shear strength were analyzed using aluminum adherends with two different roughnesses. Scanning electron microscopy was used to determine the effect of the viscosity and the roughness on the joint interface. The results showed that the adhesive exhibits an optimal value of viscosity. Below this value, at low viscosities, the low neoprene content produces poor bond strength due to the reduced toughness of the adhesive. Additionally, it also produces a high shrinkage during curing, which leads to the apparition of residual stresses that weakens the interfacial strength. However, once the optimum value, an increase in the viscosity produces a negative effect on the joint strength as a result of an important decrease in the wettability.

Index Terms— Surface roughness, Wetting, Rheology, Lap-shear, Structural acrylics

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