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The Effect of Mixing and Degassing Conditions on the Properties of Epoxy/Anhydride Resin System

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Abstract : Epoxy resin is most widely used as matrices for composites of aerospace, automotive and electronic applications due to its outstanding mechanical properties. These properties are chiefly predetermined by the chemical structure of the prepolymer and type of hardener but can also be varied by the processing conditions such as prepolymer and hardener mixing, degassing and curing conditions. In this research, the effect of degassing on the curing behaviour and the void occurrence is experimentally evaluated for epoxy /anhydride resin system. The epoxy prepolymer was mixed with an anhydride hardener and accelerator in an appropriate quantity. In order to investigate the effect of degassing on the curing behaviour and void content of the resin, the uncured resin samples were prepared using three different methods: 1) no degassing 2) degassing on prepolymer and 3) degassing on mixed solution of prepolymer and hardener with an accelerator. The uncured resins were tested in differential scanning calorimeter (DSC) to observe the changes in curing behaviour of the above three resin samples by analysing factors such as gel temperature, peak cure temperature and heat of reaction/heat flow in curing. Additionally, the completely cured samples were tested in DSC to identify the changes in the glass transition temperature (Tg) between the three samples. In order to evaluate the effect of degassing on the void content and morphology changes in the cured epoxy resin, the fractured surfaces of cured epoxy resin were examined under the scanning electron microscope (SEM). Also, the changes in the mechanical properties of the cured resin were studied by three-point bending test. It was found that degassing at different stages of resin mixing had significant effects on properties such as glass transition temperature, the void content and void size of the epoxy/anhydride resin system. For example, degassing (vacuum applied on the mixed resin) has shown higher glass transition temperature (Tg) with lower void content.

Keywords : anhydride epoxy, curing behaviour, degassing, void occurrence
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