

Synthesis and Properties of Epoxy-Siloxane Networks Containing Phosphine Oxides

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ABSTRACT

A novel diepoxide containing a phosphine oxide moiety was synthesized by reacting bis-(hydroxyphenyl)phenyl phosphine oxide with epichlorohydrin. The epoxy was characterized using ^1H NMR and was found to have 33% chain extension. This epoxy resin, as well as a bisphenol-A based diepoxide, was reacted with 1,3 bis-(3-aminopropyl)tetramethyldisiloxane. The incorporation of the phosphine oxide group exhibited increased glass transition temperature and increased char yield when compared to the networks prepared with the bisphenol based epoxy resin. The bisphenol based epoxy/siloxane network was shown to be exceptionally ductile with a fracture toughness of $2.68 \pm 0.52 \text{ Mpa}\cdot\text{m}^{1/2}$. Lap shear analysis was performed to assess the adhesive properties of the epoxy/siloxane networks with steel. Samples prepared with bisphenol and bisphenol/phosphine oxide blends resulted in interfacial failure and were in a structural regime. The incorporation of a phosphine oxide diepoxide demonstrated mixed mode failure which is suggestive of better adhesion to steel.