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Preparation of adipic acid-polyoxypropylene diamine copolymer and its application for toughening epoxy resins

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Abstract

In this study, a series of adipic acid-polyoxypropylene diamine copolymer (AA-PPA) was prepared by copolymerizing polyoxypropylene diamine (PPA D400) and adipic acid (AA). The AA-PPA with weight-average molecular weight (M_w) =10400 and weight-average molecular weight (M_n) =7600 was used to modify diglycidyl ether of bisphenol A (DGEBA) epoxy/diethyl toluene diamine (DDM) system. This extended polyether AA-PPA showed unique advantages over traditional polyether at achieving the synchronous enhancement of strength and fracture toughness. With 30 wt% AA-PPA, the bending strength, tensile strength, elongation at break and impact strength were improved by 7.50%, 6.90%, 36.13% and 288.00%, respectively. The single glass transition temperature (T_g) step proved the homogeneous phase structure of modified epoxy resins. Inevitably, the T_g of modified epoxy decreased for the addition of soft segments. The dynamic mechanical analysis (DMA) results indicated that the storage modulus of modified epoxy increased with the increasing content of AA-PPA, while the loss modulus decreased. The interaction of the crosslinked network was explained by calculating the theoretical and measured values of the molecular weight between the crosslinks. The morphology showing the ductile

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