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Block copolymer modified epoxies: Role of localized network damage[1] CARMELO DECLET-PEREZ, ERICA REDLINE[2], LORRAINE FRANCIS, FRANK BATES[3], Department of Chemical Engineering and Materials Science, University of Minnesota —
Adding block copolymers to epoxy resins has proven to be an effective approach to toughening these materials while retaining commercially relevant properties such as high modulus and glass transition temperature. When properly designed, block copolymers self-assemble into spherical micelles that disperse in the monomer resin. These structures survive curing into a dense network. At this point, a complete description of the toughening mechanism for block copolymer modified epoxies is still lacking. Here we present new experimental evidence that challenges the current understanding in this area. We compared the toughening effect of spherical micelle forming block copolymers with rubbery and glassy cores. Consistent with previous reports rubbery cores produced significant toughening, but surprisingly the glassy core micelles also imparted some toughness. These results suggest that the block copolymer/epoxy interface plays a significant role during deformation. We propose that the micelles compromise the integrity of the glassy matrix by damaging or plasticizing the crosslinked network in contact with the corona blocks, thereby facilitating shear yielding.

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