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Assessing the Strength Enhancement of Heterogeneous Networks of Miscible Polymer Blends[1] CARL GILLER, American Society for Engineering Education, MIKE ROLAND, Naval Research Lab — At the typical crosslink densities of elastomers, the failure properties vary inversely with mechanical stiffness, so that compounding entails a compromise between stiffness and strength. Our approach to circumvent this conventional limitation is by forming networks of two polymers that: (i) are thermodynamically miscible, whereby the chemical composition is uniform on the segmental level; and (ii) have markedly different reactivities for network formation. The resulting elastomer consists of one highly crosslinked component and one that is lightly or uncrosslinked. This disparity in crosslinking causes their respective contributions to the network mechanical response to differ diametrically. Earlier results showed some success with this approach for thermally crosslinked blends of 1,2-polybutadiene (PVE) and polyisoprene (PI), as well as ethylene-propylene copolymer (EPM) and ethylene-propylene-diene random terpolymer (EPDM), taking advantage of their differing reactivities to sulfur. In this work we demonstrate the miscibility of polyisobutylene (PIB) with butyl rubber (BR) (a copolymer of PIB and polyisoprene) and show that networks in which only the BR is crosslinked possess greater tensile strengths than neat BR over the same range of moduli.

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