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Stiffening, Fracture, and Friction of Physically Associating Networks by Shear Rheometry KENDRA A. ERK, KENNETH R. SHULL, Department of Materials Science and Engineering, Northwestern University — The mechanical strength, toughness, and frictional properties of soft viscoelastic networks are characterized with shear rheometry. A physically associating acrylic triblock copolymer solution is utilized as a model system. At elevated temperatures these solutions are viscoelastic liquids with near Maxwellian relaxation. The relaxation time increases dramatically as temperature is reduced, such that at room temperature the solutions effectively become viscoelastic networks. When deformed over a range of shear rates, these networks demonstrate elastically driven behavior that can be quantified via rheometry and modeled with an exponential strain energy function. During fast deformation (i.e.,Weissenberg number, Wi, greater than unity), strain-stiffening followed by softening is observed, reminiscent of fluid fracture. At decreased rates (Wi less than unity), evidence of viscoelastic- and liquid-like instabilities is observed. Additionally, post-fracture stress plateaus are found to be related to the frictional stress at the sliding fracture-like interface.

Kendra A. Erk
Department of Materials Science and Engineering, Northwestern University

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