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Tunable Strain-Stiffening of Physically Associating Networks KENDRA A. ERK, KENNETH R. SHULL, Department of Materials Science and Engineering, Northwestern University — Many biological networks become stiffer when mechanically deformed. This strain-stiffening behavior is difficult to reproduce in synthetic networks due in part to the propensity of synthetic networks to strain soften prior to the onset of stiffening. However, physically associating polymer networks frequently display stiffening behavior without softening. Here, strain-stiffening of a model elastic network of physically associating polymers is characterized by shear rheometry. The network is composed of a triblock copolymer dissolved in a midblock-selective solvent. Experiments demonstrate a correlation between network structure – specifically, variation in midblock length – and the onset of strain-stiffening, quantified using an exponential strain energy function. Fracture-like breakdown of the network is observed at large strain. The work performed here benefits from studying networks with a well-defined molecular structure and tailorable chain architecture. Control over the structure of these networks allows for the creation of synthetic networks with tunable strain stiffening.

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