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Yielding Mechanisms in Associating Telechelic Protein Hydrogels B.D. OLSEN, D.A. TIRRELL, J.A. KORNFIELD, Z.-G. WANG, California Institute of Technology — Understanding the flow of associating polymer hydrogels is important for the development of injectable biomaterials. We have investigated gels formed by telechelic proteins composed of associating coiled-coil endblocks linked by a polyelectrolyte midblock domain under both large amplitude oscillatory shear (LAOS) and capillary flow. These materials show dramatic yielding behavior that allows them to flow under low shear stress. Upon cessation of shear they almost instantaneously heal to full elastic strength, making them promising as injectable hydrogels. LAOS experiments and flow visualization suggest that these properties occur due to the formation of shear bands at high strain rates. A theoretical treatment of molecular configuration during flow has been developed to understand the molecular origins of the rheological response in telechelic polymer gels. Polymer chains are modeled as dumbbells with a FENE chain potential, and force-activated kinetics of endgroup attachment and detachment that satisfy detailed balance are used to model the transition of chains between looped, bridged, and detached chain configurations.

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