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Energy Storage and Dissipation in Random Copolymers during Biaxial Loading HANSOHL CHO, MARY BOYCE, Massachusetts Institute of Technology, MASSACHUSETTS INSTITUTE OF TECHNOLOGY TEAM — Random copolymers composed of hard and soft segments in a glassy and rubbery state at the ambient conditions exhibit phase-separated morphologies which can be tailored to provide hybrid mechanical behaviors of the constituents. Here, phase-separated copolymers with hard and soft contents which form co-continuous structures are explored through experiments and modeling. The mechanics of the highly dissipative yet resilient behavior of an exemplar polyurea are studied under biaxial loading. The hard phase governs the initially stiff response followed by a highly dissipative viscoplasticity where dissipation arises from viscous relaxation as well as structural breakdown in the network structure that still provides energy storage resulting in the shape recovery. The soft phase provides additional energy storage that drives the resilience in high strain rate events. Biaxial experiments reveal the anisotropy and loading history dependence of energy storage and dissipation, validating the three-dimensional predictive capabilities of the microstructurally-based constitutive model. The combination of a highly dissipative and resilient behavior provides a versatile material for a myriad of applications ranging from self-healing microcapsules to ballistic protective coatings.

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