

Abstract Submitted
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Polyurea segmented multi-block copolymers: structure and dynamics JAI PATHAK, JEFFREY TWIGG, C. M. ROLAND, PETER MOTT, NRL, Chemistry, DEREK HO, ERIC LIN, NIST, Polymers, MARY VUKMIR, THOMAS EPPS, Univ. of Delaware, Chemical Engineering — We study a Polyurea copolymer by measuring its stress-strain behavior between 100 and 1000 inv. s strain rate and by oscillatory shear rheology, respectively. Polyurea shows elastomeric mechanical response over a wide temperature range, as the rigid domains physically cross-link the soft domains. The modulus increases, while the residual strain in samples stretched to failure decreases with increasing strain rate. SAXS on undeformed specimens reveals two peaks: a higher wave-vector peak from semi-crystalline hard segments (long period 6 nm), and a lower wave-vector peak from micro-phase separated domains of spacing 70 nm. Polyurea specimens quasi-statically stretched to failure show anisotropic scattering, while samples stretched to failure at large strain rates show isotropic scattering, suggesting that deformation effects on morphology are controlled by rigid domain response over the deformation time-scale. Greater molecular reorganization and alignment take place at low strain rates. At large strain rates no molecular reorganization is possible, yielding identical structure as undeformed materials, pronounced strain-rate hardening and low residual strain.

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