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Phase separated microstructure and dynamics of polyurethane elastomers under strain CIPRIAN IACOB, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA 16802 USA, AJAY PADSALGIKAR, Implantable Electronic Systems Division, St. Jude Medical, Rogers, MN, USA, JAMES RUNT, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA 16802 USA — The molecular mobility of polyurethane elastomers is of the utmost importance in establishing physical properties for uses ranging from automotive tires and shoe soles to more sophisticated aerospace and biomedical applications. In many of these applications, chain dynamics as well as mechanical properties under external stresses/strains are critical for determining ultimate performance. In order to develop a more complete understanding of their mechanical response, we explored the effect of uniaxial strain on the phase separated microstructure and molecular dynamics of the elastomers. We utilize X-ray scattering to investigate soft segment and hard domain orientation, and broadband dielectric spectroscopy for interrogation of the dynamics. Uniaxial deformation is found to significantly perturb the phase-separated microstructure and chain orientation, and results in a considerable slowing down of the dynamics of the elastomers. Attenuated total reflectance Fourier transform infrared spectroscopy measurements of the polyurethanes under uniaxial deformation are also employed and the results are quantitatively correlated with mechanical tensile tests and the degree of phase separation from small-angle X-ray scattering measurements.

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