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Influence of Grain Boundaries on the Deformation Behavior of Block Copolymers: In Situ SAXS Tensile Deformation and Simulation of Bicrystals PANITARN WANAKAMOL, Dept of Materials Science and Engineering, MIT, THEODORA TZIANETOPOULOU, Dept of Mechanical Engineering, MIT, MARY C. BOYCE, Dept of Mechanical Engineering, MIT, EDWIN L. THOMAS, Dept. of Materials Science and Engineering, MIT — The evolution of the microdomain structure of block copolymers (BCP) during tensile deformation have been studied using transmission electron microscopy (TEM) and small angle x-ray scattering (SAXS). Most previous studies have been conducted on isotropic, polygranular materials, where the role of grain boundaries on the deformation is largely unknown. In order to develop a fundamental understanding of boundary defects on the deformation, we have utilized model bicrystals. Such ideal grain boundaries are made by first producing a near-single crystal BCP sample using the roll casting process and then cutting appropriate pieces and adhering these together to yield bicrystal BCP specimens with various types of tilt or twist boundaries. The reciprocal space patterns obtained dynamically using SAXS and step-scanning the small cross-section beam across the boundary region after each increment of applied strain provide detailed insight into the structural evolution of the microdomain across the grain boundaries. A theoretical study using finite element analysis of the deformation of each grain was also performed to compare with the experimental work.

Panitarn Wanakamol
Dept of Materials Science and Engineering, MIT

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