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Structure of Epitaxially Assembled Block Copolymer Domains[1]
GILA STEIN, University of Houston, J. ALEXANDER LIDDLE, NIST-CNST, ANDREW AQUILA, UC Berkeley, ERIC GULLIKSON, LBNL — Epitaxial self-assembly of block copolymers is promising for integrated circuit patterning, but it is unclear how the shape of the block copolymer domains is deformed by the epitaxy process, or if the intrinsic roughness of the block copolymer interface is too large to be suitable for manufacturing. We use soft x-ray diffraction to characterize the size, shape, and interface structure of poly(styrene-*b*-methyl methacrylate) (PS-PMMA) block copolymer domains assembled on an epitaxial template. The shapes of the PS and PMMA phases are deformed when the equilibrium domain sizes are incommensurate with the line widths of the underlying template, and mismatch as small as $(7 \pm 3)\%$ produces a PS sidewall angle of $(1.6 \pm 0.2)^\circ$. The average width of the copolymer interface is (4.9 ± 0.1) nm. Comparison with mean-field theoretic predictions for the structure of block copolymer interfaces suggests a low-frequency variance in the copolymer interface position of 1.2 nm^2, or a low-frequency line-edge roughness of approximately $3\sigma = 3$ nm. The low-frequency roughness is attributed to thermal fluctuations, and the magnitude is well-described by a simple capillary wave model for polymer interfaces.

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