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Shear-alignment of metal-containing block copolymer thin films for nanofabrication SO YOUN KIM, RICHARD REGISTER, Princeton University, JESSICA GWYTHER, IAN MANNERS, University of Bristol, PAUL CHAIKIN, New York University — Cylinder-forming block copolymers can be used as etch masks for the fabrication of nanowire grids, with both fine resolution and scalability. However, achieving a high aspect ratio in these nanostructures, where reactive ion etching is employed for pattern transfer, requires strong etch contrast between two blocks of the copolymer. We achieve this strong contrast by using metal-containing block copolymers: materials which either contain metal as synthesized, or which can be selectively metallized after deposition as thin films. In the first case, iron-containing polystyrene-b-poly(ferrocenylisopropylmethylsilane) (PS-PFS) forming PFS cylinders was employed, and a spin-coated film was aligned by shearing with a polydimethylsiloxane pad. In the second case, polystyrene-b-poly-2-vinylpyridine (PS-P2VP) was deposited as a film, shear-aligned, and then platinum was selectively sequestered within the P2VP cylinders by brief soaking in an aqueous solution of a Pt salt. In both cases, shear stress produced alignment over centimeter-scale areas; this alignment was retained for PS-P2VP during the selective metallization. The line pattern in these aligned block copolymer thin films is then transferred via reactive ion etching into amorphous silicon deposited onto a quartz wafer to fabricate silicon nanowire grid polarizers which can operate at deep ultraviolet wavelengths.

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