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High Aspect Ratio Sub-15 nm Silicon Trenches From Block Copolymer Templates XIAODAN GU, University of Massachusetts Amherst, ZUWEI LIU, Oxford Instrument, ILJA GUNKEL, DEIRDRE OLYNICK, Lawrence Berkeley National Lab, THOMAS RUSSELL, University of Massachusetts Amherst, UNIVERSITY OF MASSACHUSETTS AMHERST COLLABORATION, OXFORD INSTRUMENT COLLABORATION, LAWRENCE BERKELEY NATIONAL LAB COLLABORATION — High-aspect-ratio sub-15 nm silicon trenches are fabricated directly from plasma etching of a block copolymer (BCP) mask. Polystyrene-b-poly(2-vinyl pyridine) (PS-b-P2VP) 40k-b-18k was spin coated and solvent annealed to form cylindrical structures parallel to the silicon substrate. The BCP thin film was reconstructed by immersion in ethanol and then subjected to an oxygen and argon reactive ion etching to fabricate the polymer mask. A low temperature ion coupled plasma with sulfur hexafluoride and oxygen was used to pattern transfer block copolymer structure to silicon with high selectivity (8:1) and fidelity. The silicon pattern was characterized by scanning electron microscopy and grazing incidence x-ray scattering. We also demonstrated fabrication of silicon nanoholes using polystyrene-b-polyethylene oxide (PS-b-PEO) using same methodology described above for PS-b-P2VP. Finally, we show such silicon nano-strucutre serves as excellent nano-imprint master template to pattern various functional materials like poly 3-hexylthiophene (P3HT).

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