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Directed self-assembly of lamellae-forming block copolymer with density multiplication for high aspect ratio structures XUANXUAN CHEN, The University of Chicago, PAULINA RINCON DELGADILLO, The University of Chicago, IMEC, ZHANG JIANG, JIN WANG, JOSEPH STRZALKA, Advanced Photon Source, Argonne National Laboratory, PAUL NEALEY, The University of Chicago, IMEC COLLABORATION, ADVANCED PHOTON SOURCE, ARGONNE NATIONAL LABRATORY COLLABORATION — Directed self-assembly (DSA) of block copolymers provides the means to control structure over micro- and macroscopic dimensions. We investigate the potential for DSA to control nanostructure through sub-micron film thickness and realize near perfect structure in the plane of the film over macroscopic areas. Lamellae-forming poly (styrene) - block - poly (methyl methacrylate) (L_0 =28.5nm) was directed to assemble on chemical patterns with a pitch (L_S) of 84nm. The three-dimensional structure of the films was characterized by SEM and GISAXS as a function of the geometry and chemistry of the chemical pattern, film thickness, and thermal annealing time. At optimal conditions, perpendicular through film structures was achieved with aspect ratio of 12 over 5 x 8 mm^2 areas in 3 hours at 250 C. At non-optimal boundary conditions, time for assembly increases, and the maximum film thickness decreases, suggesting an assembly mechanism involving nucleation of structure at the pattern and free surface and differing governance of the pattern-directed structure in both the thermodynamics and kinetics of the system. GISAXS experiments reveals that a significant number of defect structures persist within the films even after the surface structures are perfectly aligned.

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