Abstract Submitted
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**Long-range Ordering of Symmetric Block-copolymers by Chaining of Superparamagnetic Nanoparticles in External Magnetic Fields** V. RAMAN, M.I.T, A. BOSE, University of Rhode Island, B.D. OLSEN, T.A. HATTON, M.I.T — Chaining of superparamagnetic nanoparticles is numerically investigated as a new method to align the block copolymer without additional lithographic processing. The method relies on the chaining of superparamagnetic nanoparticles, sequestered preferentially in one of the blocks, in the direction of in-plane external magnetic fields to achieve long-range order in the block copolymer. Effects of nanoparticle size, concentration, and magnetization strength are explored using Hybrid-Particle-Field technique (Sides et al, 2006). The 2D simulations reveal that, for the same nanoparticle loading, the nanoparticle sizes commensurate with the domain sizes yield defect-free alignment. While small sizes lead to jamming and kinetic trapping of defects, larger sizes lead to swelling of domains and break the symmetry of the lamellar phase. A window of optimal nanoparticle concentrations exists over which orientational order is achieved. For low concentrations, only local alignment is observed, while high concentrations lead to order-order phase transition from lamellae to cylindrical phase. Scaling calculations corroborate the effect of high magnetization strengths in lowering the equilibrium defect density for such nematic-isotropic phase transitions observed in monolayers.

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