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Thickness and Confinement Effects on the Morphology of Gyroid PS-PDMS Thin Films WUBIN BAI, KEVIN GOTRIK, ADAM HANNON, ALFREDO ALEXANDER-KATZ, Massachusetts Institute of Technology, APOSTOLOS AVGEROPOULOS, University of Ioannina, CAROLINE ROSS, Massachusetts Institute of Technology — The self-assembly of thin films of a block copolymer with a bulk gyroid structure was examined for a range of thicknesses and annealing conditions. The poly(styrene-b-dimethylsiloxane) (SD80, 80kg/mol, f_{PDMS} =40%, PDI =1.07) formed a gyroid structure in bulk (the microdomain period, Lo∼45 nm). Thin films were spin-cast from 1% solution of SD80 in toluene and annealed in co-solvent vapors consisting of mixed toluene and heptane vapors, which swelled the film by a factor of 2.2 - 2.4. The morphology of the microdomains was revealed by removing the PS with oxygen plasma. Thick films (>∼2Lo) showed gyroid-like morphologies, but thinner films (∼Lo) exhibited perforated lamellar structures whose period varied slowly with film thickness. Self-consistent field theory simulations reproduced the wetting layer – perforated lamella – gyroid morphological transitions with increasing thickness. Results are compared with a 45 kg/mol PS-PDMS/homo-PDMS blend with the same f_{PDMS}, and templating of the perforated lamellae by substrate topography is described. The perforated lamellae structures produced by these methods can be used as templates for fabricating highly ordered periodic arrays of nanowires or magnetic dots with tunable sizes.

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