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Graphoepitaxy of Block Copolymer as a Route to Patterning Macroscopic Length Scales with a Single Long-Range Grain Orientation G.E. STEIN, H. COTA, A. HEXEMER, E.J. KRAMER, UCSB — The order of a monolayer of spherical domain poly(styrene-*b*-2 vinyl pyridine) block copolymer melt confined laterally in hexagonal wells is investigated as a function of thermal history and monolayer thickness. The hexagonal geometry is designed to match the hexagonal symmetry of the 2D crystalline and hexatic phases. The wells are 25nm deep, range in width from 7 to 30μm between parallel edges, and adjacent wells are separated by mesas 2μm wide. All thermal treatments begin with a disordered film that uniformly covers the wells and mesas. The best order is obtained for a monolayer $\mathbf{t}^\star$-nm thick that is briefly heated to the 2D liquid, followed by a slow cooling through a hexatic intermediate to the 2D crystalline phase. The result is a single crystal with long-range orientational order and a low dislocation density in wells up to 12μm wide. The close-packed rows align with the well edge, so the orientation across all neighboring wells is correlated. When the monolayer thickness $\mathbf{t}$ deviates from $\mathbf{t}^\star$ by -20%, a high density of dislocation defects is induced instead of hole formation.

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