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Defect generation in thin films of block copolymer cylinders: the effect of cylinder spacing and film thickness VINDHYA MISHRA, EDWARD KRAMER, Univ of California Santa Barbara — Understanding the fundamental physics of disordering and defect generation in block copolymer (BCP) films is important for directed assembly based block copolymer lithography. We investigate the defect generation in, and smectic-nematic-isotropic transition temperature T_m of, monolayers and bilayers of poly (styrene-b-2vinyl pyridine) diblock copolymer cylinders aligned parallel to the substrate in 2 micron wide channels. Quantitative AFM studies were supplemented with grazing incidence small angle X-ray diffraction line-shape analysis to quantify the decay of translational and orientational correlation functions with increasing temperature. We find that T_m decreases, and the dislocation density n below T_m increases, if either the number of layers or the cylinder spacing a decreases. These results are expected since $n \sim \exp(-E_d/kT)$ and E_d, the dislocation formation energy, scales as a^2h, where h is film thickness. Since only a 10% decrease in a produces a dramatic increase in n, these results suggest that using 2D smectic structures such as BCP cylinders aligned parallel to, or BCP lamellae normal to, a substrate to produce more closely spaced features will result in patterns with more and more defects.

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