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Dilute Micelle Arrays in Block Copolymer Thin Films JOHN PAPALIA, RICHARD REGISTER, Princeton U., DOUGLAS ADAMSON, U. Connecticut, PAUL CHAIKIN, NYU — Thin films of sphere-forming block copolymers are attractive templates for surface patterning and nanofabrication. While the areal density of spheres (micelles) can be adjusted through the diblock's molecular weight, sparse micelle arrays are quite difficult to achieve. Instead, we blend the diblock with matrix homopolymer in the "dry brush" regime, which eliminates the "terracing" (island/hole formation) present in films of the neat diblock. Furthermore, by choosing a system where the sphere-forming block wets the substrate and/or free surface, we can achieve very sparse micelle arrays without correspondingly extensive homopolymer dilution, by using the film thickness as the control parameter rather than the blend ratio. Specifically, we employ a polystyrene-polyisoprene diblock (PS/PI blocks of 68/12 kg/mol), blended with PS homopolymer; the PI block wets both the free surface and the SiOx substrate. For sufficiently thin films (<60 nm for 50 wt% homoPS), all the block copolymer goes to form brush-like layers at the two surfaces, yielding no micelles. For thicker films, sufficient block copolymer remains to form spherical microdomains between the brushes; the areal density of micelles can be continuously tuned via the film thickness. We evaluate this approach by preparing a film with a thickness gradient, and apply a simple model to the measured areal densities of micelles.

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