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Micelle Formation of Diblock Copolymer in a Thin Film Homopolymer: a Comparison with Polymer Brush-Coated Nanoparticles

HENGXI YANG, CHELSEA CHEN, PETER GREEN, University of Michigan — We investigated micelle formation of a diblock copolymer polystyrene-*b*-poly(2-vinylpyridine) (PS-*b*-P2VP) of degree of polymerization N , in thin films of homopolymer polystyrenes (PS) of different degrees of polymerization P , supported on substrates, and compared the results with the phase behavior of PS brush-coated Au nanoparticles in homopolymer PS matrix. PS-*b*-P2VP copolymer chains aggregated to form micelles, composed of an inner P2VP core and an outer PS corona. The size of the micelle cores, D_{core} , increased with increasing P , and reached a plateau at very large P . The transition occurred at a larger P/N than expected from brush-melt interaction theories. The organization of micelles at large P regimes suggested attractions between micelles. P2VP block also adsorbed onto the substrate to form a brush layer and the surface adsorption process was affected by micellization of copolymers. We compared the micelle formation of PS-*b*-P2VP in PS with the phase behavior of PS coated Au nanoparticle/PS mixtures: the host chains penetrate into the corona of the micelles more easily than into the PS brush grafted on the particle due to low “grafting density;” what’s more, micelles can self-adjust their aggregation number as the interaction between host chains and the corona changes.

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