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Understanding Segregation Processes in Blends of Bottlebrush-Linear Polymer Thin Films INDRANIL MITRA, University of Houston, XIANYU LI, Envia Systems, STACY L. PESEK, Rice University, BORIS MAKARENKO, University of Houston, BRAD S. LOKITZ, DAVID UHRIG, JOHN F. ANKNER, Oak Ridge National Laboratory, RAFAEL VERDUZCO, Rice University, GILA E. STEIN, University of Houston — Bottlebrush polymer thin films have potential to generate surface coatings for a variety of applications ranging from tailored surface wettability and adhesion, antifouling surface coatings and self-assembled photonics. In this study, we examined the phase behavior for athermal blends of bottlebrush polystyrene (PS) and linear deuterated polystyrene (dPS) in thin films. The bottlebrush loading was 10% by volume, and the ratio of linear dPS chain length to bottlebrush PS side chain length was systematically varied in the range of $\alpha = 0.3 - 41$. The depth-dependent concentration of bottlebrush was measured using dynamic secondary ion mass spectroscopy. When $\alpha < 2$, the bottlebrushes are dispersed throughout the film thickness with a slight excess at the free surface and substrate interface. When $\alpha > 8$, the bottlebrushes are depleted from the interior of the film and segregated at the interfaces. This behavior is consistent with wetting and dewetting transitions at a melt/brush interface and entropic attraction of highly branched polymers to surfaces. This work demonstrates that brushlike surfaces and interfaces can be generated in a linear polymer film through spontaneous, entropy driven segregation of properly designed bottlebrush additives.

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