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Decoupling Substrate Surface Interactions in Block Polymer Thin Film Self-Assembly CAMERON SHELTON, THOMAS EPPS, University of Delaware — Understanding the impact of the major factors that affect block polymer (BP) thin film self-assembly is necessary to control nanostructure ordering, orientation, and defect density. In this work, we systematically studied the influence of the substrate surface energy, one of the most significant parameters directing self-assembly, on wetting behavior, through-film interactions, and substrate surface field propagation. Notably, we determined the applicability of decoupled surface energy components (dispersive and polar interactions) as opposed to total surface energy, using a suite of chlorosilane monolayers and UV-ozone degradation to create a library of total, dispersive, and polar surface energy effects. Our experimental results combined with surface chemistry literature indicated repulsive total surface energy interactions are the dominant force at the substrate-polymer interface, whereas attractive decoupled surface energy interactions become significant past the contacting layer. This work represents a thorough analysis of a vital force affecting BP self-assembly as well as a blueprint for the generalized design of substrate surfaces that achieve target BP nanostructure orientations for nanolithography, templating, and nanoporous membrane applications.

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