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Beneath the Surface: Understanding Patterns of Intra-Domain Orientational Order ISHAN PRASAD, University of Massachusetts Amherst, YOUNGMI SEO, LISA HALL, The Ohio State University, GREGORY GRASON, University of Massachusetts Amherst — Block copolymers (BCP) self assemble into a rich spectrum of ordered phases due to asymmetry in copolymer architecture. Despite extensive study of spatially-ordered composition patterns of BCP, knowledge of orientational order of chain segments that underlie these spatial patterns is evidently missing. We show using self consistent field (SCF) theory and coarse-grained molecular dynamics (MD) simulations that, even without explicit orientational interactions between segments, BCP exhibit generic patterns of intra-domain segment orientation, which vary both within a given morphology and from morphology to morphology. We find that segment alignment is usually both normal and parallel to the interface within different local regions of a BCP sub-domain. We describe principles that control relative strength and directionality of alignment in different morphologies and report a surprising yet generic emergence of biaxial segment order in morphologies with anisotropic curved interfaces, such as cylinders and gyroid phases. Finally, we focus our study on cholesteric textures that pervade mesochiral BCP morphologies, specifically alternating double gyroid (aDG) and helical cylinder (H*) phases, and analyze patterns of twisted (nematic and polar) segment order within these domains.

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