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Leveraging intrinsic chain anisotropy to align coil-coil block copolymers with magnetic fields YEKATERINA ROKHLENKO, KAI ZHANG, MANESH GOPINADHAN, Yale University, STEVE LARSON, University of WisconsinMadison, PAWEL MAJEWSKI, KEVIN YAGER, Brookhaven National Lab, PADMA GOPALAN, University of WisconsinMadison, COREY O'HERN, CHINEDUM OSUJI, Yale University — Magnetic field alignment of block copolymers (BCPs) has typically relied on the presence of liquid crystalline or crystalline assemblies to provide sufficient magnetic anisotropy to drive alignment. Recent experiments however show that alignment is also possible in simple coil-coil BCPs. In particular, alignment of lamellae was observed in poly(styrene-b-4-vinylpyridine) (PS-P4VP) on cooling across the order-disorder transition at field strengths as low as 1 T, with alignment improving markedly with increasing field strength and decreasing cooling rate. Here we discuss the intrinsic chain anisotropy which drives the observed alignment, and its display as a net microdomain anisotropy due to chain tethering at the block interface. We use in-situ X-ray scattering to study the phase behavior and temperature-, time-, and field- dependent dynamics of magnetic alignment in coil-coil BCPs, highlighting the important roles of chain anisotropy and grain size in alignment. For the right combination of field strength and grain size, we can leverage intrinsic chain anisotropy to magnetically direct self-assembly in other coil-coil systems, including cylinder-forming poly(styrene-b-dimethylsiloxane). Field alignment of PS-P4VP with PEO and other blends provides a route to form functional materials such as nanoporous films and ion conducting polymers.

Yekaterina Rokhlenko
Yale University

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