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Alignment pathways and the effect of a Nematic-Smectic A transition on the orientational order of an LC block copolymer under magnetic fields[1] MANESH GOPINADHAN, YOUNGWOO CHOO, PAWEL MAJEWSKI, CHINEDUM OSUJI, Department of Chemical and Environmental Engineering, Yale University, New Haven, Connecticut 06511, USA — We explore the effect of magnetic fields on the thermodynamics and alignment kinetics of a liquid crystalline block copolymer (LCBCP) using in situ SAXS. We examine the effect of magnetic fields on the order-disorder transition temperature (T_{ODT}), alignment pathways and the effect of liquid crystal ordering on the orientational order of the system. The application of the field did not result in any discernable shift in the phase behavior of the system. This is consistent with our observation that alignment occurred by slow grain rotation rather than by selective melting of field-destabilized grains, which is further supported by time and temperature resolved measurements. Zero field cooling conducted after field-annealing in the nematic phase result in highly-aligned structures despite the initial weak alignment in the nematic window. The strong enhancement of the alignment is correlated with the emergence of a smectic mesophase and highlights the strong orientational coupling of the BCP interfaces to the orientation of the smectic layer normal, k, and not to the molecular director field of the mesogens, n. These results suggest that the presence of a smetic A mesophase and the nematic-smectic sequence can be leveraged in designing schemes for magnetic field directed self-assembly of block copolymers.

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Manesh Gopinadhan
Department of Chemical and Environmental Engineering, Yale University,
New Haven, Connecticut 06511, USA

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