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In-situ SAXS observation of magnetic field effects on block copolymer ordering and alignment[1] CHINEDUM OSUJI, MANESH GOPINADHAN, PAWEL MAJEWKSI, Dept. of Chemical and Environmental Engineering, Yale University — The use of external fields to direct block copolymer self-assembly is well documented. Magnetic fields offer particular promise due to their space-pervasive nature and the ability to produce arbitrary alignments over truly macroscopic length scales in appropriate systems. We present here the results of in-situ SAXS studies of side-chain liquid crystalline diblock copolymers ordering under high magnetic fields and ex-situ GISAXS data on thin films. Despite the coincidence of the block copolymer order-disorder transition (ODT) and the LC clearing temperature in these weakly segregated materials, there is no measurable effect of the field on the ODT of the system, up to 6 T. This is in line with rough estimates based simply on the magnitudes of the relevant energy scales - the free energy of field interaction and the enthalpy of the isotropic-LC transition. We show that the alignment of the system is critically limited by the viscosity of the mesophase such that alignment can only be advanced by residence in a small temperature window near T_{ODT}. This residence produces a weakly aligned system which thereafter transitions to a strongly aligned state on cooling even in the absence of the field.

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