Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Orientational control of block copolymer microdomains by sub-tesla magnetic fields[1] MANESH GOPINADHAN, YOUNGWOO CHOO, XUNDA FENG, KOHSUKE KAWABATA, XIAOJUN DI, CHINEDUM OSUJI, Yale University — Magnetic fields offer a versatile approach to controlling the orientation of block copolymer (BCP) microdomains during self-assembly. To date however, such control has required the imposition of large magnetic fields (>3T), necessitating the use of complex magnet systems – either superconducting or very large conventional resistive magnets. Here we demonstrate the ability to direct BCP self-assembly using considerably smaller fields (<1T) which are accessible using simple rare-earth permanent magnets. The low field alignment is enabled by the presence of small quantities of mesogenic species that are blended into, and co-assemble with the liquid crystalline (LC) mesophase of the side-chain LC BCP under study. In situ SAXS experiments reveal a pronounced dependence of the critical alignment field strength on the stoichiometry of the blend, and the ability to generate aligned microdomains with orientational distribution coefficients exceeding 0.95 at sub-1 T fields for appropriate stoichiometries. The alignment response overall can be rationalized in terms of increased mobility and grain size due to the presence of the mesogenic additive. We use a permanent magnet to fabricate films with aligned nanopores, and the utility of this approach to generate complex BCP microdomain patterns in thin films by local field screening are highlighted.

[1]NSF DMR-1410568 and DMR-0847534

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Date submitted: 06 Nov 2015 Electronic form version 1.4