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Single crystals and bespoke textures in self-assembled nanostructured soft materials

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3:00pm, refreshments at 2:45pm

66-110

Abstract:

This presentation explores newly developed strategies for directing self-assembly in nanostructured soft materials to create single crystals and bespoke textures. Our work elucidates relevant physical processes, in part by leveraging in situ scattering tools, with an overall goal of exploiting fundamental understanding to create useful materials or devices.

First, we explore advances in magnetic field directed self-assembly of soft mesophases of block copolymers and discotic liquid crystals. A novel application of orthogonal fields, and sequential field processing across different phase transitions enable, for the first time, the creation of macroscopic single crystals of self-assembled mesophases. Recent exciting progress on low field (sub-1 T) alignment and the associated potential to develop bespoke textures in block copolymers using local field screening are presented.

Second, we examine electrospray deposition as a repurposed tool to generate well-ordered block copolymer thin films in a manner inspired by physical vapor deposition processes used in hard materials. The success of the method relies on slow deposition of sub-attoliter quantities of material delivered in sub-micron droplets produced by electrospray atomization. We demonstrate the ability to continuously deposit thin films with controlled orientation of microstructure, and to assemble heterostructures through sequential depositions of materials.