Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Shear Alignment of Perpendicular Lamellae in Block Copolymer Thin Films[1] RICHARD REGISTER, SASWATI PUJARI, Princeton University, PAUL CHAIKIN, New York University — Thin supported block copolymer films, containing a single layer of cylindrical microdomains lying parallel to the substrate, can be effectively aligned by applying a shear stress to the molten, ordered film. Such films have been used effectively as contact masks for pattern transfer via reactive ion etching, permitting the fabrication of in-plane nanowire arrays, where the nanowires are aligned over macroscopic (cm) distances. Such a nanowire array could also be formed from a film which contains lamellae whose interdomain interfaces lie perpendicular to the substrate; such a template film would in principle allow for the formation of nanostructures of high aspect ratio, provided that the lamellae can be aligned along a single in-plane direction while retaining their perpendicular orientation. We have generated such films of perpendicular lamellae in a polystyrene-poly(methylmethacrylate) diblock, PS-PMMA, by neutralizing the substrate with a random terpolymer brush. Shearing the film, using a moving polydimethylsiloxane (PDMS) pad in contact with the film surface, can indeed produce alignment over cm-scale distances; however, the orientational order is poorer and the defect density higher than in typical cylinder-forming systems, and a significantly higher stress is required. After peeling off the PDMS pad, both PS and PMMA blocks are exposed at the surface in thinner films, but for films thicker than one domain spacing, the lower-energy PS block tends to cap the film surface, overlaying aligned perpendicular lamellae.

[1]support from PCCM (NSF-MRSEC, DMR-0819860)

Richard Register
Princeton University

Date submitted: 15 Nov 2011 Electronic form version 1.4