Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Directed Assembly of Block Copolymer Cylinders: Fundamental Physical Limits to Cylinder Spacing[1] VINDHYA MISHRA, GLENN H. FREDRICKSON, Department of Chemical Engineering, UCSB, EDWARD J. KRAMER, Departments of Materials and Chemical Engineering, UCSB — Understanding the fundamental 2D physics of disordering and defect generation in block copolymer films is important in setting the limits for directed assembly based block copolymer lithography. Our experiments on monolayer films of cylindrical morphology block copolymer show that the monolayer structure disorders at a lower temperature compared to the bulk order-disorder transition temperature by thermal generation of a critical density of dislocations (point defects in the monolayer). We demonstrate experimentally and theoretically how this process sets lower limits on the monolayer cylinder spacing and thus pattern spacing that can be achieved by directed assembly of a given block copolymer using graphoepitaxy. Self-consistent field theoretic simulations are used to predict the compressional elastic constant B of the cylinder monolayer and cylinder spacing a as a function of χN and f, the minor block volume fraction. In turn these are used to estimate the formation energies E_d ($\sim Ba^3$) of dislocations in cylinder monolayers of various block copolymers.

[1]We acknowledge funding from NSF DMR-07-04539 and DMR-09-04499

Edward J. Kramer
Departments of Materials and Chemical Engineering, UCSB

Date submitted: 10 Nov 2011 Electronic form version 1.4