SB-3

Highly Tunable Block Copolymer Self-assembly for Nanopatterning

정연식†, 정재원

KAIST
(ysjung@kaist.ac.kr†)

Nanoscale block copolymer (BCP) patterns have been pursued for applications in sub-30 nm nanolithography. BCP self-assembly processing is scalable and low cost, and is well-suited for integration with existing semiconductor fabrication techniques. However, one of the major technical challenges for BCP self-assembly is limited tunability in pattern geometry, dimension, and functionality. We suggest methods for extending the degree of tunability by choosing highly incompatible polymer blocks and utilizing solvent vapor treatment techniques. Siloxane BCPs have been developed as self-assembling resists due to many advantages such as high etch-selectivity, good etch-resistance, long-range ordering, and reduced line-edge roughness. The large incompatibility leads to extensive degree of pattern tunability since the effective volume fraction can be easily manipulated by solvent-based treatment techniques. Thus, control of the microdomain size, periodicity, and morphology is possible by changing the vapor pressure and the mixing ratio of selective solvents. This allows a range of different pattern geometry such as dots, lines and holes and critical dimension simply by changing the processing conditions of a given block copolymer without changing a polymer chain length. We demonstrate highly extensive tunability (critical dimension ~6~30 nm) of self-assembled patterns prepared by a siloxane BCP with extreme incompatibility.

Keywords: Block copolymer, Self-assembly, Lithography

SB-4

Order-to-disorder Behavior of Block Copolymer Films

류두열†, 김은혜, 최승훈

연세대학교
(dryru@yonsei.ac.kr†)

Block copolymer (BCP) self-assembly in a film geometry has recently been the focus of increased research interest due to their potential use as templates and scaffolds for the fabrication of nanostructured materials. The phase behavior in a thin film geometry that confines polymer chains to the interfaces will be influenced by the interfacial interactions at substrate/polymer and polymer/air and the commensurability between the equilibrium period (L0) of the BCP and the total film thickness. We investigated the phase transitions for the films of block copolymers (BCPs) on the modified surface, like the order-to-disorder transition (ODT) by in-situ grazing incidence small angle x-ray scattering (GISAXS) and transmission electron microscopy (TEM). The selective interactions on the surface by a PS-grafted substrate provide the preferential interactions with the PS component of the block, while a random copolymer (PS-r-PMMA) grafted substrate do the balanced interfacial interactions on the surface. The thickness dependence of order-to-disorder behavior for BCP films will be discussed in terms of the surface interactions.

Keywords: Self-assembly, Block copolymer