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Systematic tunability of self-assembled block copolymer patterns
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The morphology and length scale of diblock copolymers (BCPs) are determined by the chain lengths, and therefore to obtain different geometries and feature sizes, polymers with different chain lengths or BCP/homopolymer blends have been employed. Here, we report on the solvent vapor induced tunability of pattern dimension and morphology of thin films of polystyrene-polydimethylsiloxane (PS-*b*-PDMS) BCPs, which provide robust patterns with exceptionally good ordering due to their large interaction parameter.[1] Vapor pressure can control the interfacial interaction between the two blocks, and a mixed solvent can manipulate the effective volume fraction of each block. We show both coupled and independent control of the microdomain size and the periodicity by changing the vapor pressure and the mixing ratio of a selective (heptane) and a partially selective (toluene) solvent. We also demonstrate the transformations from spheres to cylinders and from cylinders to perforated lamellar structures by increasing the portion of selective solvent in the vapor. These results are supported by a theoretical model.

[1]Y. S. Jung *et al.*, Nano Letters 7, pp. 2046-2050 (2007); Science 321, pp. 939 - 943 (2008); Nano Letters 8, pp. 2975-2981 (2008)

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