Directed Assembly of Diblock Copolymer on Nano-Patterned Substrates
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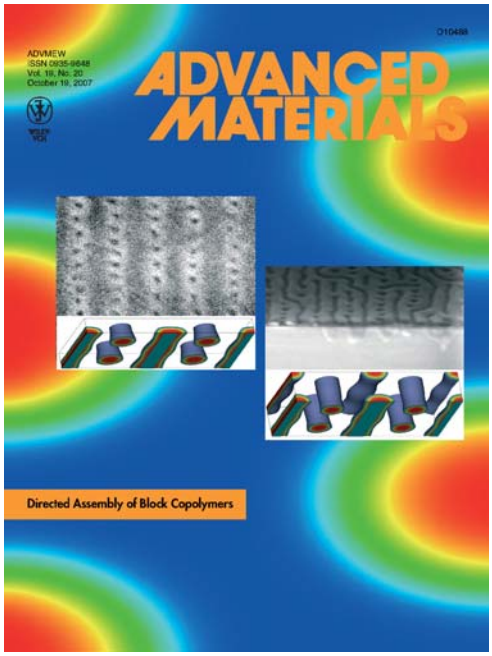
Block copolymers are representative self-assembling materials extensively utilized in nanofabrication. Developing a robust method for obtaining well-ordered morphology of block copolymers, however, has been challenging. Recently, the collaborative work between Wang's computational group at Colorado State University and Kim's experimental group at Korea Advanced Institute of Science and Technology demonstrates that, by judicious control of the substrate pattern and film thickness, well-ordered complex nanostructures can be obtained in block copolymer films casted on incommensurate substrate patterns. Such directed assembly of a cylinder-forming diblock copolymer on a chemically stripe-patterned substrate with a period (~100nm) twice of the natural period of the copolymer, produces an array of nanocylinders alternatively oriented perpendicular and parallel to the substrate and well-registered with the substrate pattern. The three-dimensional structure in the thin film and its formation mechanism are clearly resolved by real-space self-consistent field calculations and in good agreement with experimental observations. This work shows that combining top-down and bottom-up approaches may provide a versatile pathway for obtaining well-registered complex nanostructure in block copolymer films. Further development of the directed assembly technique may provide useful template materials for various applications such as plasmonic waveguide and nanowire array.



References/Publications

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