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Imprint strategy for directed self-assembly of block copolymers

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Abstract

The directed self-assembly (DSA) of block copolymers (BCP) has attracted high interest for the definition of nanostructures in an almost self-forming way when adequate boundary conditions are given. At present, grapho- and chemo-epitaxy are the workhorses but they require precisely patterned substrates to serve as the guiding pattern. Nanoimprint may replace this laborious pre-patterning of each substrate by employing an adequate stamp that can be used multiple times, inducing the guided DSA from the top of the film. Here, the DSA of BCPs is revisited in view of the specific nanoimprint situation. As a consequence, the BCP layer is imprinted in a partial cavity-filling mode, using a stamp of sufficient height provided with a conventional anti-sticking layer; substrate pre-treatment is minimized or rather avoided. Even with a highly preferential substrate it is possible to obtain vertical lamellae that are largely oriented in parallel to the stamp edges in PS-b-PMMA (polystyrene-block-polymethyl methacrylate) already after 3 min of imprint. The vertical lamellae are at least 70 nm high, freestanding on the substrate. Though optimization is required the results indicate the high potential of nanoimprint to simplify the DSA of BCPs for technical applications, also beyond Si technology.

Keywords: thermal nanoimprint, block copolymers, strategy, directed self-assembly