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Nanocellular formation of supercritical CO_2 in block copolymer thin films HIDEAKI YOKOYAMA, LEI LI, National Institute of Advanced Industrial Science and Technology, TAICHI NEMOTO, KENJI SUGIYAMA, Tokyo Institute of Technology — The production of large-area structured surfaces with a featured size of nanometer scale still remains a challenge by conventional photolithography. In particular, block copolymer thin films have been considered as the ideal lithography templates. Here we present our novel supercritical carbon dioxide (scCO_2) process to fabricate thin films with a single layer of empty cells of a diameter of ca. 30 nm in block copolymer thin films. By absorbing CO_2 in CO_2-philic block domains of a block copolymer followed by depressurization, empty cells are introduced in CO_2-philic domains. This process was successful even in a block copolymer thin films with a thickness less than 100 nm. The typical nanocellular structures introduced by our novel scCO_2 process (10MPa) have an average spacing of 34 nm and a density of 9×10^{10} cm^{-2}. The size and the spacing of such nanocells can be adjusted by changing saturation pressure of scCO_2. The obtained structures are significantly different from those expected from the volume ratio of domains swollen by CO_2. Spherical cells in block copolymer thin films are found even when the porosity is more than 30%.

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