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Buckling of block copolymer lamellae in supercritical carbon dioxide HIDEAKI YOKOYAMA, MASATERU ITO, YASUHIRO SAKAI, KOZO ITO, The University of Tokyo, KENJI SUGIYAMA, Tokyo Institute of Technology — Supercritical carbon dioxide ($scCO_2$) swells many kinds of polymers. In particular polymers containing fluorine are highly swollen. Therefore, block copolymers having fluorinated blocks are expected to be swollen selectively in $scCO_2$ due to the higher affinity of $scCO_2$ toward the fluorinated blocks. We studied the phase behavior of fluorinated block copolymers swollen in $scCO_2$ and found multiple order-to-order transitions as a function of pressure. In addition, the swollen structures could be frozen by reducing temperature and subsequently carbon dioxide was removed without disturbing the swollen morphologies. As a result, the volume occupied with carbon dioxide was converted to empty space, and hence a variety of nanoporous structures were successfully formed. In particular we found that swollen lamellae in $scCO_2$ becomes undulated lamellae with a large wavelength, which is similar to "egg cartoon" often observed in unbinding membranes of surfactants.

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