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Self-Consistent Field Theoretical Study on the Crossed Cylinder Morphology of Block Copolymers[1] JAEUP KIM, SO JUNG PARK, YEONGYOON KIM, UNIST — Cylindrical morphologies are commonly observed for various block copolymer systems. Both theory and experiment confirm that the stable bulk morphology is hexagonally packed parallel cylinders. However, it does not necessarily mean that other types of arrangements are impossible. In this work, we explore a few possible strategies to promote the formation of crossed cylinder geometry. Our self-consistent field theoretical calculations along with experiments of our collaborators demonstrate that such crossed cylinder morphology is obtainable if the system is well designed and prepared. One strategy is to use surface interaction energy. If a block copolymer thin film resides on a substrate with stripe shaped chemical patterns which prefer one block, cylinders parallel to the pattern is energetically favorable on the stripe. However, on the neutral region, thin film confinement promotes cylinders vertical to the substrate. Another strategy is to use locally inclined substrates. In general, cylinders vertical to the substrate have difficulty in fitting themselves on a non-flat substrate and they prefer to lie down on the substrate. These strategies are applicable for the formation of other non-traditional crossed geometries such as the crossed lamellar morphology.

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