A coarse-grained model of poly (styrene)-poly (butadiene)-poly (tert-butylmethacrylate) (PS-PI-PMMA) triblock copolymer was used to study the self-assembly of specific characteristic nanostructures such as core-shell variations of body-centered cubic (BCC), hexagonal packed cylinders (HEX), hexagonally perforated layers (HPL), gyroid (GYR), and lamellar (LAM) via order-disorder transition (ODT). The BCC, HEX, HPL, GYR and LAM nanostructures were analyzed under thermal cycles of heating and cooling. The order-order phase transition (OOT) HEX to BCC was scanned, and two new transitions, GYR to LAM and LAM to HPL, were found during the thermodynamic process. The HPL nanostructure was classified as metastable due to its lack of thermodynamic equilibrium. It has been concluded that order-order transitions can also be carried out the sideways, being a thermoreversible process. The outcomes of this study are compared with the composition modifications of previous works, which hold the same pattern of transition. This work enhances the knowledge about the nanostructure properties of the PS-PB-PtBMA triblock copolymer and complements the development of new thermoresponsive materials and applications.

**Keywords:** nanostructures, order-order transitions, thermosensitive

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