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ABSTRACT:

Ordered Polymer Nanostructures Driven from Self-Assembly and Crystallization

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The development of nanostructured materials based on block copolymers (BCPs) and nanoporous polymers characterized by tunable periodicities variable in a wide length scales will be described. The polymer nanostructures form by self-assembly and phase separation in block copolymers due to the incompatibility between the different linked polymers. Moreover, the use of semicrystalline BCP improves the material mechanical properties and introduces a method for controlling the orientation of nanodomains through the control of the crystallization associated to the phase separation. The development of innovative processing methods of BCPs allows achieving high order in the orientation of nanodomains that, in turn, affords producing ordered nanopatterns on the surface of polymer films. The advantage of this bottom-up approach is related to the spontaneous self-assembly of nanostructures with size of microdomains and periodicity easily engineered by controlling the molecular structure, that is, type of linked polymer blocks and their molecular masses. This high control of the molecular architecture and the introduction of crystallizable polymer blocks has been possible thanks to the development of innovative synthetic strategies. Many possible applications of these ordered nanostructures in different fields of nanotechnologies will be described.