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Processing Cyclic Peptide-polymer Conjugates in Block Copolymer Thin Films for Sub-nm Porous Membranes[1] CHEN ZHANG, University of California at Berkeley, TING XU, University of California at Berkeley, Lawrence Berkeley National Laboratory — Porous thin films containing subnanometer channels oriented normal to the surface exhibit unique transport and separation properties and can serve as selective membranes for separation. Inspired by natural protein channels, we have developed an approach using cyclic peptide nanotubes (CPNs) embedded in polymeric matrix to mimic the transport of natural channels. The co-assembly of polymer-covered CPNs in a block copolymer (BCP) thin film requires the synchronization of two self-assembly processes, namely the microphase separation of BCP and the nanotube growth of CP-polymer conjugates. We systematically investigated the co-assembly of isolated CP-poly(ethylene glycol) (CP-PEG) conjugates and polystyrene-b-poly (methyl methacrylate) (PS-b-PMMA) in thin films as a function of CP-PEG loading (f_{CP-PEG}) and solvent-polymer interactions. We find that there is a strong dependence of the co-assembly process on f_{CP-PEG} due to thermodynamic limit of incorporating one CPN in one PMMA microdomain, as well as the kinetic pathway in which favorable PEG-solvent interaction helps to disperse CPNs and thus lowers the activation energy barrier of the system. This study presents critical insights in guided assemblies of functional building blocks within nanoscopic frameworks.

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