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Characterization of Block Copolymer Self-Assembly: From Solution to Nanoporous Membranes YACHIN COHEN, LIAT OSS-RONEN, YESHAYAHU TALMON, JUDITH SCHMIDT, Technion, Israel, AUREL RADULESCU, Forschungszentrum Juelich, Germany, VOLKER ABETZ, Helmholtz-Zentrum Geesthacht, Germany — Nanoporous membranes, exhibiting a dense assembly of pores with a narrow size distribution, are fabricated by self-assembly of block copolymers in solution. In particular, a scalable solution casting process reported recently, provides a "one-step" method to prepare such isoporous membranes by casting a block copolymer solution. We study the state of micellization in the initial casting solution and its transformation by addition of water, in order to elucidate the formation mechanism of the dense isoporous structure, using a combination of cryogenic-temperature electron microscopy and small-angle neutron scattering. Contrast variation is employed to matching each respective block. We show that the starting point for membrane formation is a micellar solution with the hydrophilic minor blocks within the micelle core. As water is introduced, this structure is preserved in a system which is far from equilibrium, as the hydrophobic majority blocks densify outside the more hydrophilic micelle cores. This non-equilibrium structure is the progenitor of the cylindrical pores, formed as water continues to enter the system.

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