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Block copolymer self-assembly derived ultrafiltration membranes: From science to start-up.

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In the last ten years a novel method to generate asymmetric ultrafiltration membranes has been established. It is based on the combination of block copolymer self-assembly with non-solvent induced phase separation (NIPS) and is now referred to as SNIPS. NIPS as an industry proven method for the formation of phase inversion membranes opening a pathway to scale up and commercialization of these membranes. The combination of NIPS with block copolymer self-assembly leads to asymmetric membranes with narrow pore size distributions in the top surface layer (so called isoporous membranes) as well as high pore densities, thereby potentially combining high resolution with high flux in membrane separation processes. Such membranes have potential applications in the biopharmaceutical industry where a large fraction of the costs are currently associated with time-consuming non-membrane based separation processes. This talk will describe a family of isoporous ultrafiltration membranes based on the self-assembly behavior of an ABC triblock terpolymer which has led to the formation of a start-up company out of Cornell University. After introduction of the SNIPS process in general, and its application to such ABC triblock terpolymers in particular, open scientific questions associated with the formation mechanisms of the top surface separation layer in such membranes is discussed, which is at the heart of enabling high performance separation behavior. Furthermore, challenges translating scientific work into industrial settings are highlighted.