Switchable asymmetric water transport in dense nanocomposite membranes

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Directional transport of water has technological relevance in several applications, from separation processes[1] to functional clothing[2] and smart packaging[3]. While this feature has been widely implemented in asymmetric porous materials to achieve directional wetting,[4] studies on non-porous membranes with directional water transport are rather limited. As part of a renewed interest in this topic, our group recently developed dense nanocomposite membranes inspired by plant cuticles that exhibit asymmetric water transport characteristics.[5]

Here we report compositionally asymmetric membranes based on a hydrophobic poly(styrene)-*block*-poly(butadiene)-*block*-poly(styrene) (SBS) copolymer and hydrophilic polyvinyl alcohol (PVA) nanofibers. The water-induced plasticization of PVA, combined with the asymmetric structure, results in directional water transport when the membranes are exposed to large relative humidity (RH) gradients. The directionality can easily be tuned by varying the composition of the membranes, enabling the development of a wide variety of new materials with switchable asymmetric water transport that may be useful for packaging applications.

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