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Charge Mosaic Membranes Fabricated from Chemically Tailored Copolymer Materials WILLIAM PHILLIP, SIYI QU, SHERWOOD BENAVIDES, AARON HUNTER, YI SHI, HAIFENG GAO, University of Notre Dame —
The majority of state-of-the-art membranes implemented in water treatment processes utilize a size-selective, steric exclusion mechanism to sort dissolved solutes from solution. Catalyzed by recent advances that provide nanoscale control over material architectures, next generation membranes are pushing the limits of size-selective separations. As such, there is a growing interest in chemically-selective membranes that allow for efficient separations based on chemical factors. In this work, we discuss the use of a copolymer-derived membrane platform, which can be post-synthetically modified, in the production of chemically-selective charge mosaic membranes. These mosaic membranes possess distinct, counter-charged domains that cover the membrane surface and traverse the membrane thickness. This unique nanostructure allows dissolved salts to permeate through the mosaic more rapidly than water, even though water is three times smaller in size. A series of pressure-driven solute rejection experiments conducted over a range of ionic strengths demonstrate this distinct transport property and offer insights into the fundamental mechanisms governing the performance of these novel membranes. Through this example, we demonstrate that membranes that are based on nanostructured copolymer materials provide a scalable and efficient platform that can be tailored to myriad chemically-selective separations in future applications.

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