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A Comparison of Water Diffusion in Polymer Based Fuel Cell and Reverse Osmosis Membrane Materials CHRISTOPHER SOLES, BRADLEY FRIEBERG, JACOB TARVER, MADHUSUDAN TYAGI, CHEOL JEONG, EDWIN CHAN, CHRISTOPHER STAFFORD, NIST - Natl Inst of Stds Tech — Hydrated polymer membranes are critical in both fuel cells and water filtration and desalination. In both of these applications the membrane function (selectively transporting or separating ions) is coupled with the transport of water through the membrane. There is a significant need to understand the nature by which the water and ions distribute and move through these membranes. This presentation compares the transport mechanisms in in an ion containing block copolymer alkaline fuel cell membrane with that of a polyamide membrane that is used as the active layer in a reverse osmosis water desalination membrane. Small angle neutron scattering measurements are used to locally probe how water swells the different materials and quantitatively describe the distribution of water within the membrane microstructures. Quasielastic neutron scattering measurements are then used to separate the polymer dynamics of the host membranes from the dynamics of the water inside the membranes. This reveals that water moves at least an order of magnitude slower through the ion containing fuel cell membrane materials, consistent with a solution-diffusion model, while the water in the polyamide membranes moves faster, consistent with a pore-flow diffusion mechanism. These insights will be discussed in terms of a coupling of the water and polymer dynamics and design cues for high performance membrane materials.

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