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Salt transport properties of model reverse osmosis membranes using electrochemical impedance spectroscopy KATHLEEN FELDMAN, EDWIN CHAN, GERY STAFFORD, CHRISTOPHER STAFFORD, NIST — With the increasing shortage of clean water, efficient purification technologies including membrane separations are becoming critical. The main requirement of reverse osmosis in particular is to maximize water permeability while minimizing salt permeability. Such performance optimization has typically taken place through trial and error approaches. In this work, key salt transport metrics are instead measured in model reverse osmosis membranes using electrochemical impedance spectroscopy (EIS). As shown previously, EIS can provide both the membrane resistance R_m and membrane capacitance C_m, with R_m directly related to salt permeability. The membranes are fabricated in a molecular layer by layer approach, which allows for control over such parameters as thickness, surface and bulk chemistry, and network geometry/connectivity. R_m, and therefore salt permeability, follows the expected trends with thickness and membrane area but shows unusual behavior when the network geometry is systematically varied. By connecting intrinsic material properties such as the salt permeability with macroscopic performance measures we can begin to establish design rules for improving membrane efficiency and facilitate the creation of next-generation separation membranes.

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