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Salt uptake and dynamics in thin, highly crosslinked polyamide membranes KATHLEEN FELDMAN, EDWIN CHAN, CHRISTOPHER STAFFORD, National Institute of Standards and Technology — Water purification membranes have historically been developed through an Edisonian, trial and error approach. It has been challenging to establish fundamental structure-property-performance relationships, including salt\water permselectivity, in large part due to the typically rough and poorly-defined nature of the polyamide membrane active layer. By using molecular layer by layer (mLbL) deposition, we are able to produce thin, well-defined polyamide films with controlled chemistry analogous to commercial reverse osmosis and nanofiltration membranes. While water permeation in polyamide membranes is reasonably straightforward to measure, salt permeation is more challenging, particularly in ultrathin films. We measure both equilibrium salt uptake and dynamic behavior in nanofiltration-type membranes using x-ray photoelectron spectroscopy (XPS), electrochemical impedance spectroscopy (EIS), and quartz crystal microbalance (QCM). By connecting intrinsic material properties such as the salt permeability and permselectivity with macroscopic performance measures we can begin to establish design rules for improving membrane efficiency while lowering energy requirements.

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