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Understanding Schroeder's Paradox ADAM WEBER, AHMET KUSOGLU, Lawrence Berkeley National Laboratory — Schroeder's paradox is a well known, but not fully understood, phenomenon that exists in many polymers and gels. Essentially, the uptake of solvent in the polymer depends on the interaction with the boundary phase. Nafion, a polymer of interest for many electrochemical energy applications, is a classic example where the water uptake almost doubles by placement in liquid water versus saturated water vapor. In this talk, we examine the origin of this paradox through examination of Nafion morphology and water-uptake time constants using experiments in various solvents, vacuum, and small-angle X-ray scattering techniques. The results show that the interface controls the water uptake (even in bulk membranes) and that the interfacial morphology depends on the interactions of the different polymer moieties with the external environment including its density and dielectric constant. In addition, interactions with solid phases will be discussed which show similar impact on water uptake depending on whether they are hydrophilic or hydrophobic. Understanding the morphological changes and their associated impact on membrane properties is critical for optimizing polymers for use in energy applications.

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