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Structure-Property Relationship of Perfluorinated Sulfonic Acid (PFSA) Membranes AHMET KUSOGLU, ADAM WEBER, Lawrence Berkeley National Laboratory — Perfluorosulfonic-acid (PFSA) membrane is the most commonly used ionomer in electrochemical energy storage and conversion devices thanks to its remarkable proton conductivity, perm-selectivity, wide electrochemical window, and mechanical stability. Most of these properties are the result of the membrane's phase-separated nanostructure where ions and solvents transport through the hydrated domains while the surrounding hydrophobic PTFE backbone acts as a mechanical support. Thus, it is essential to understand the solvent- and humidity-induced morphological changes and their associated impact on the membrane's properties for optimizing the structure-property relationship desired by the electrochemical devices. In this talk, correlations among the mechanical (e.g., modulus), electrochemical (e.g., ionic conductivity) and nanostructural (e.g., domain spacing) properties during hydration is discussed. Moreover, the impact of thermal history, mechanical reinforcement, and side-chain length on the structure-property correlation is examined. Even though the properties vary for the membranes investigated, similar correlations are found between the degree of hydration, domain spacing, and ionic conductivity.

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