Importance of electrostatic interactions in the mobility of cations in Nafion

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Nafion membranes are polysulfonated teflon membranes and are selective towards cations. It is widely believed that there are water channels present in the membrane that are responsible for conducting cations. The conductivity of Nafion decreases by an order of magnitude upon decreasing the water content. The primary reason has been ascribed to the breaking up of water channels which are of hundreds of nanometers. On the contrary we have observed that proton transfer is hindered in molecular dimensions. We have even observed disruption of this proton transport even through one water molecule.^{1,2} We ascribe the reason to enhanced electrostatic interactions upon reducing the water content. We have used Excited State proton transfer (ESPT) in Coumarin 102 (C102), 2-(2'-Pyridyl)-benzimidazole (2PBI) and (2,2'-Bipyridyl)-3,3'-diol to explore proton transfer process in the nafion membrane.



Scheme 1: Effect of drying on mobility of ions in Nafion membrane

References

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