MAR16-2015-003537

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

Quantifying Contributions to Transport in Ionic Polymers Across Multiple Length Scales

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Self-organized polymer membranes conduct mobile species (ions, water, alcohols, etc.) according to a hierarchy of structural motifs that span sub-nm to >10 μm in length scale. In order to comprehensively understand such materials, our group combines multiple types of NMR dynamics and transport measurements (spectroscopy, diffusometry, relaxometry, imaging) with structural information from scattering and microscopy as well as with theories of porous media,[1] electrolytic transport, and oriented matter.[2] In this presentation, I will discuss quantitative separation of the phenomena that govern transport in polymer membranes, from intermolecular interactions ($\leq$ 2 nm),[3] to locally ordered polymer nanochannels (a few to 10s of nm),[2] to larger polymer domain structures (10s of nm and larger).[1] Using this multi-scale information, we seek to give informed feedback on the design of polymer membranes for use in, *e.g.*, efficient batteries, fuel cells, and mechanical actuators.

References:

1. J. Hou, J. Li, D. Mountz, M. Hull, and L. A. Madsen. *Journal of Membrane Science* **448**, 292-298 **(2013)**.

2. J. Li, J. K. Park, R. B. Moore, and L. A. Madsen. *Nature Materials* **10**, 507-511 **(2011)**.

3. M. D. Lingwood, Z. Zhang, B. E. Kidd, K. B. McCreary, J. Hou, and L. A. Madsen. *Chemical Communications* **49**, 4283 - 4285 **(2013)**.