**Emerging Basic Science Questions Regarding Water and Ion Transport in Polymers for Water Purification and Resource Recovery**

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Synthetic polymer membranes play a significant role in water purification today and are poised to be even more important in the future as more highly impaired waters are purified and as the need for resources found in such waters, such as lithium, grow extraordinarily rapidly. Transport of water and ions in polymers is at the heart of these applications, such as concentration driven reverse osmosis and electric field driven electrodialysis. Old questions regarding the fundamental mechanism of water transport in polymers are being re-asked, providing fresh challenges to what has been regarded as well-resolved, settled science in the field. In many proposed new applications, such as lithium recovery from brine, ion concentrations are much higher than in earlier applications, such as brackish and seawater desalination. Both thermodynamic and dynamic nonideal phenomena related to ion pairing/association, which are not accounted for in traditional models for desalination membranes, become increasingly important in these new applications. This presentation will highlight open questions in the field and future opportunities.