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SPEAKER SERIES

PRESENTS

Precise Polymer Microstructures Produce Nanoscale Morphologies for Improved Transport Properties (a joint IBNS/TcSUH Seminar)

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The University of Pennsylvania

11:00 am, Friday, April 2, 2021
Room: Zoom*

https://uofh.zoom.us/j/845619943?pwd=QlZvYUV6M2dxNDkvNWxBd3F2YzdJZz09
Meeting ID: 845 619 943
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LECTURE ABSTRACT

Polymer synthetic chemistry can now provide remarkable control over polymer microstructures, including the placement of associating functional groups in acid- and ion-containing polymers. We initially studied precise linear polyethylenes synthesized by acyclic diene metathesis to reveal a variety of self-assembled nanoscale morphologies. Currently, we are studying precise sulfophenylated polyethylene ionomers synthesized by ring opening metathesis. Through a combination of X-ray scattering and atomistic molecular dynamics, we found that both the acid (p5PhSA) and neutralized (p5PhSA-X, where X is Li+, Na+, Cs+) forms of this polymer exhibit percolated aggregates that promote transport. The proton conductivity of p5PhSA surpasses that of Nafion. In addition, we are investigating segmented ionomers synthesized by step-growth polymerization and containing polar units with neutralized sulfonate groups separated by a precise number (n = 10 - 48) of methylene groups (PESn-X). These PESn-X ionomers are multiblock copolymers with exceptional long-range order, order-order transitions, and occasionally order-disorder transitions. The most promising of these ordered structures is the double gyroid structure. This 3D interconnected morphology exhibits higher ionic conductivity than the isotropic layered or hexagonal morphologies in PES23-Li. These studies combine to build robust structure-property relationships for transport in single-ion conductors that will guide innovative polymer design for improved ion transport properties.

SPEAKER BIOSKETCH

Prof. Karen I. Winey is the Department Chair, Professor and TowerBrook Foundation Faculty Fellow of Materials Science and Engineering at the University of Pennsylvania. She received her B.S. in materials science from Cornell University and her Ph.D. in polymer science and engineering from the University of Massachusetts, Amherst. Following a postdoctoral position at AT&T Bell Laboratories, she joined the faculty of the University of Pennsylvania. Her research lies in characterizing and manipulating nanoscale structures in ionomers and associating polymers to develop materials with improved mechanical and transport properties. Dr. Winey is a Fellow of the American Physical Society (2003), a Fellow of the Materials Research Society (2013), and a Fellow of the PMSE Division within the American Chemical Society (2016). In 2020, she was honored with both the Herman Mark Senior Scholar Award from the Polymer Division of the American Chemical Society and the Braskem Award from the Materials Engineering and Science Division of the American Institute of Chemical Engineering. Karen has also held a variety of leadership roles including chair of the Polymer Physics Gordon Research Conference (2010), chair of the Division of Polymer Physics within the American Physics Society (2013-14), and department chair (2016 -).

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