

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT SPRING COLLOQUIUM SERIES  
PRESENTS:

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## *Precise Polymers that Control Nanoscale Morphologies & Transport Properties*

Acid- and ion-containing polymers have specific interactions that produce acid- or ion-rich aggregates arranged in hierarchical nanoscale morphologies and remarkable bulk properties. Untangling the correlations between the primary structure of such associating polymers and their morphologies and properties has long been a challenge in polymer physics, because most acid- and ion-containing polymers have random sequences of polar and non-polar monomeric units. New synthetic methods increasingly produce polymers with greater molecular precision that provide greater uniformity of and control over the hierarchical morphologies. Using primarily X-ray scattering experiments and atomistic molecular dynamics simulations, we have revealed a variety of new nanoscale morphologies in precise acid- and ion-containing polymers (layers, branched aggregates, gyroid). In addition to describing these new morphologies, this seminar will present proton and ion conductivity results for a variety of precise polymers that demonstrate the importance of these new nanoscale morphologies.

**Karen I. Winey** received her B.S. from Cornell University in materials science and engineering 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 in 1992. Karen characterizes and manipulates nanoscale structures in ionomers and associating polymers to develop materials with improved mechanical and transport properties. Recently, she discovered new structures in several acid- and ion-containing precise polyethylenes. Karen also designs and fabricates polymer nanocomposites to understand and improve their mechanical, thermal, and electrical properties, particularly transparent conductors. Polymer motion in the presence of nanoparticles and in nanoconfinement are currently areas of interest. Across these research areas, Karen couples experimental studies with simulation and theory, either within her group or with collaborators. Karen has served the research community as Chair of the Division of Polymer Physics within the American Physical Society (2013) and as Chair of the Polymer Physics Gordon Research Conference (2010). Winey also served as an Associate Editor for *Macromolecules* (2010-14), the leading journal in the field. Karen has numerous honors including Fellow of the American Physical Society (2003), George H. Heilmeyer Faculty Award for Excellence in Research (2012), Fellow of the Materials Research Society (2013), Visiting Miller Research Professor at the University of California, Berkeley (2014), Fellow of the PMSE Division within the American Chemical Society (2016) and the Trustees Council of PennWomen Award for Undergraduate Advising (2018).

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