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Distinguished Seminar Speaker

Nanoconfined Polymerizations: Kinetics and Thermodynamics

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Abstract: The behavior of materials confined at the nanoscale has been of considerable interest over the past several decades, especially changes in the glass transition temperature (T_g) and/or melting point (T_m). Less well studied are the effects of nanoconfinement on polymerization kinetics and thermodynamics. Our recent focus has been on understanding how nanoconfinement influences various classes of polymerizations, including step growth, chain, and ring-opening polymerizations. We find that changes in reaction rates under confinement can generally be explained by a competition between changes in local packing, diffusivity, and surface effects. The result is generally, but not always, an acceleration of the rate of the nanoconfined polymerization. In addition, nanoconfinement influences the chain length, polydispersity, and tacticity of free-radically synthesized polymers, making confinement a potential tool for controlling synthetic outcomes. Finally, in the case of equilibrium chain polymerizations, nanoconfinement influences the monomer/polymer equilibrium shifting it back towards monomer; this effect can be exploited to test scaling theories in the literature concerning confinement entropy.

Biography: Prof. Sindee L. Simon obtained her B.S. in Chemical Engineering at Yale University in 1983 and her Ph.D. in Chemical Engineering at Princeton University in 1992. She started her career at the University of Pittsburgh, then spent twenty years at Texas Tech moving up the ranks from Associate Professor to P.W. Horn Distinguished Professor to Department Chair. In 2021, she moved to NC State University where she is Distinguished Professor and Department Head of Chemical and Biomolecular Engineering. Dr. Simon's research interests include the physics of the glass transition, cure and properties of thermosetting materials, and properties and reactivity at the nanoscale. She has published over 140 refereed journal publications, has over 8,000 citations and an h-index of 49 according to Google Scholar. She has received numerous honors, including Fellowships in the American Physical Society, the Society of Plastics Engineers (SPE), the North American Thermal Analysis Society (NATAS), the American Institute of Chemical Engineers, and the American Association for the Advancement of Science (AAAS). She is also the recipient of the 2019 SPE International Award, as well as the SPE Research/Technology Award and the NATAS Outstanding Achievement Award.