THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT FALL COLLOQUIUM SERIES PRESENTS:

Dorn Lecture

Professor Nancy Sottos

Department Head, Swanland Endowed Chair and Center for Advanced Study
Professor of Materials Science and Engineering
University of Illinois Urbana-Champaign

Frontal polymerization-induced morphogenic patterning

Materials with hierarchical architectures that combine soft and hard material domains with coalesced interfaces possess superior properties compared to their homogeneous counterparts. This talk describes the control of material properties through morphogenic pattern formation during frontal polymerization of cyclooctadiene (COD) with comonomer ethylidene norbornene (ENB). Tuning of the reaction kinetics and thermal transport gives rise to spin mode instabilities and the formation of amorphous and semi-crystalline domains emerging from the internal interfaces generated between the solid polymer and the propagating cure front. The size, spacing, and arrangement of the domains are controlled by the interplay between the reaction kinetics, thermodynamics, and boundary conditions. Comparison of the structure of polymers made with the three different initiators reveals reproducible variations in the orientation of the polymer chains with respect to direction of front propagation. We characterize the influence of these patterned domains on the tensile strength, elastic modulus, and toughness of the polymer. The spatial distribution and alignment of chains, alongside the packing of lamellae lead to significant increases in fracture toughness in preferred orientations.

Nancy Sottos holds the Swanlund Endowed Chair and is Head of the Department of Materials Science and Engineering at the University of Illinois Urbana Champaign. She is leader of the Autonomous Materials Systems (AMS) group at the Beckman Institute for Advanced Science and Technology, director of the EFRC on Regenerative Energy Efficient Manufacturing of Thermoset Polymeric Materials (REMAT), and leads the University of Illinois spoke of the BP International Center for Advanced Materials (ICAM). Sottos is also a co-founder of the start-up companies Autonomous Materials Inc. (AMI) and RapiCure Solutions. Her current research interests focus on circular additive and morphogenic manufacturing strategies for polymeric and composite materials with programmed end of life. She is a member of the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences. She is a Fellow of the Society for Experimental Mechanics, the Society for Engineering Science, and the American Association for the Advancement of Science.

Tuesday, October 1 • 4 pm CT • Tech L211

Small reception to follow in the Willens Wing Atrium

In person only; no Zoom

Questions? Contact allison.macknick@northwestern.edu

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