THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT SPRING 2025 COLLOQUIUM SERIES PRESENTS:

DOW Lecture

Professor Thomas H. Epps, III

Professor of Chemical & Biomolecular Engineering and Materials Science & Engineering

University of Delaware

Improving Materials Circularity – Linking Polymer Science and Life-Cycle Analysis

Approaches that valorize biomass and plastics waste have continued to emerge in recent years. One common strategy is deconstruction/depolymerization, whereby polymers are degraded into smaller molecules by various reaction pathways. The dynamics of these complex systems of molecules, with evolving molecular weights and molecular weight distributions that span the range from monomer up to commodity polymer, are a strong function of process technology. Hence, efficient development of deconstruction technologies and potential application-oriented use cases will benefit from simple and descriptive models that link material characteristics and process parameters to physical properties and product distributions. We have applied these models and learnings to both biobased and petroleum-based macromolecules. As one example, we have recently achieved the chemical recycling and upcycling of laboratory-based and commercial heteroatom-containing, petroleum-based feedstocks demonstrating the ability to chemically depolymerize both thermoplastics and thermosets back to monomers that can be repolymerized to generate new or upgraded polymeric materials. Additionally, we have begun to identify the impact of additives and impurities on the effectiveness and longevity of catalysts employed in deconstructing plastics waste to develop robust strategies for feedstock purification and catalyst regeneration. Overall, this work in biobased and petrochemical macromolecules offers new pathways to 'closing the loop' on the life cycle for higher-performance polymer systems.

Thomas is the Allan & Myra Ferguson Distinguished Professor of Chemical & Biomolecular Engineering at the University of Delaware (UD) with a joint appointment in Materials Science & Engineering. He is Director of the Center for Research in Soft matter & Polymers (CRiSP), Director of the NSF MRSEC at UD called CHARM (Center for Hybrid, Active, and Responsive Materials) and Deputy Director of the DOE EFRC at UD called CPI (Center for Plastics Innovation, recently renewed). His research interests include soft materials from biobased and plastics waste feedstocks, polymeric materials for ion-conduction membranes, polymer composites for toxic agent remediation, and nanostructured assemblies for targeted drug delivery and gene therapy. More specifically, his group leverages expertise in chemical engineering, materials science, and polymer science to design materials, systems, and unit operations that address challenges associated with sustainability, alternative energy, and human health. He was elected a Fellow of the American Physical Society in 2017, Royal Society of Chemistry (FRSC) in 2018, American Institute for Medical and Biological Engineering in 2021, POLY Division of the American Chemical Society in 2021, American Chemical Society in 2021, and the National Academy of Inventors in 2022, PMSE Division of the American Chemical Society in 2023, and AIChE in 2023. Thomas is also co-founder and Chief Scientific Officer of Lignolix, Inc. – a company focused on the valorization of biomass. He has received several honors and awards including: the Eminent Chemical Engineering Award (AIChE, 2023), the William W. Grimes Award (AIChE, 2021), Percy L. Julian Award (NOBCChE, 2020); John H. Dillon Medal (APS, 2016); Owens-Corning Early Career Award (AIChE, 2015), among others. Thomas is a member of the DOE Basic Energy Sciences Advisory Committee, NSF Math & Physical Sciences Directorate Advisory Committee, and a member of advisory boards/committees in the private and financial sector.

Tuesday, May 6 • 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

Northwestern | McCORMICK SCHOOL OF ENGINEERING