SEPTEMBER 12, 2025 | 102 Colburn Lab @ 10:15 AM

CHRISTIAN PESTER

University of Delaware

ENGINEERING OF FUNCTIONAL POLYMER COATINGS – FROM SELF-HEALING TO PHOTOCATALYSIS

Seminar co-hosted by Center for Research in Soft matter & Polymers (CRiSP)

Christian Pester received his Diploma in Polymer and Colloid Chemistry from the University of Bayreuth (Germany) and his doctorate from RWTH Aachen (Germany) working with Prof. Alexander Böker (DWI – Leibniz Institute for Interactive Materials, Germany). He graduated summa cum laude and was awarded the Borcher's Medal for his dissertation on "Block Copolymers in Electric Fields." He then was an Alexander-von-Humboldt Feodor-Lynen Postdoc with Profs. Edward Kramer and Craig Hawker at the University of California, Santa Barbara. His independent academic career began at Penn State, where he was named the Thomas K. Hepler Early Career Professor in Chemical Engineering and awarded tenure in 2023. Since 2024, Christian is an Associate Professor of Materials Science and Engineering at University of Delaware and a visiting researcher at the Leibniz Institute of Resilience Research (Mainz, Germany). He was awarded the NSF CAREER, ACS PMSE Young Investi-gator, and TOSOH Excellence in Polymer Science award.

The covalent attachment of polymers has emerged as a powerful strategy for the preparation of multi-functional surfaces and interfaces. These surface-grafted polymer brushes provide improved durability, longevity, and functionality, e.g., by enabling coatings that can respond 'intelligently' to a variety of external stimuli. This presentation describes recent advances in our group in developing user-friendly chemical and engineering techniques to produce func-tional polymer brush coatings via surface-initiated (SI) photoinduced electron/energy transfer (PET) reversible addition–fragmentation chain transfer (RAFT) polymerization. Oxygen toler-ance, mild reaction conditions, and the use of visible light make this approach robust and ver-satile for applications from anti-microbial surfaces to anti-fogging coatings and robust coat-ings that can self-heal incisions within seconds. Polymer brushes are also used as a new het-erogeneous photocatalysis platform based on photocatalyst-functionalized polymers grafted to micron-scale glass beads. The resulting photocatalytic materials can be used for light-mediated organic transformations, controlled photopolymerizations, and wastewater remedia-tion. Recyclability of the heterogeneous catalyst and re-use for multiple reactions is possible, while the covalent tether avoids catalyst contamination of the synthetic products.

University of Delaware

CHEMICAL & BIOMOLECULAR ENGINEERING

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SEPTEMBER 5, 2025 | 102 Colburn Lab @ 10:15 AM

ALLAN P. COLBURN MEMORIAL LECTURER

ANGELA PITENIS

University of California, Santa Barbara

NEUTRON REFLECTOMETRY AND HYDROGEL TRIBOLOGY

Seminar co-hosted by Mechanical Engineering (MEEG)

Angela Pitenis is an associate professor in the Materials Department at the University of California, Santa Barbara. Her research interests are focused on understanding the fundamental mechanisms of friction, deformation, and wear across soft, biological, and bio-inspired materials. She leads a multidisciplinary team of materials scientists, mechanical engineers, and molecular biologists and has co-authored over 60 refereed journal articles. Angela also serves as the IRG-2 co-leader for the Materials Research Laboratory, a MRSEC Program of the National Science Foundation under Award No. DMR 2308708. She was awarded the NSF CAREER award in 2021, the UC Santa Barbara Margaret T. Getman Service to Students award in 2022, and the Society of Tribologists and Lubrication Engineers Early Career Award in 2024.

Hydrogels are compactly described as three-dimensional networks of hydrophilic polymer chains swollen in solvent. This class of materials has enjoyed widespread utility in biomedical applications (e.g., contact lenses, joint repair, surgical coatings) due to their ability to exhibit similar ranges in bulk mechanical properties as tissues (elastic modulus of about 1 to 100 kPa) by controlling water content and crosslink density. High water content hydrogels (>90% water) are often qualitatively described as “slippery” or “lubricious,” although their precise lubrication mechanisms are not well understood. Here, we present a first-of-its-kind sample environment, “tribometer”, designed for hydrogel friction measurements on the Liquids Reflectometer at Oak Ridge National Laboratory. Our initial results suggest that polymer density is correlated with increasing contact pressure -- in agreement with prior compression studies -- as well as sliding velocity. The results of this research may lead to the informed design of more robust and lubricious hydrogels and coatings for use in biomedicine.