



Monday, February 14<sup>th</sup> | 3:30 PM | via Zoom

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## Taking advantage of complexity: Leveraging heterogeneity to tailor soft material performance

**Dr. Caroline Szczepanski**—Assistant Professor, Department of Chemical Engineering and Materials Science at Michigan State University

**Abstract:** Numerous natural materials have properties and performances that have inspired, intrigued, and motivated engineers. Examples include plant surfaces that are self-cleaning, adhesives that persist in aqueous environments, as well as insect shells that can harvest water from fog. Common amongst these natural materials are hierarchical structures, ranging from macromolecular design up to microscopic features and patterning. Unfortunately, an ongoing challenge with replicating these designs using biomimicry is identifying straight-forward, versatile techniques to recapitulate intricate and complex designs. Research in the Szczepanski group confronts this challenge by identifying strategies based in polymer chemistry and polymer engineering to recreate the unique functionalities of natural materials. We use heterogeneous design to create unexpected and synergistic performance compared to currently applied technologies. This talk will highlight recent work from my group on this theme, including studies investigating how in situ stress gradients can be leveraged during photopolymerizations to create patterned and hierarchical structures at an interface. I will also describe recent efforts in the group focused on the use of bio-sourced and bio-inspired additives to improve composites and adhesives. These examples, as well as other ongoing projects in our research group, provide a new framework to optimize bulk properties and performance of polymeric materials via purposeful design.

**Biography:** Caroline Szczepanski is an assistant professor in the Department of Chemical Engineering and Materials Science at Michigan State University. The research in Dr. Szczepanski's group utilizes polymer science and polymer engineering to produce biomimetic materials and interfaces. Recent efforts in her group includes developing novel monomers for use in dental adhesive applications, designing micro- and nanostructured interfaces for controlled wettability and adhesion, and utilizing bio-based materials in nanocomposites. Dr. Szczepanski received her BS from Lafayette College in 2009 and her PhD from the University of Colorado in 2014. After completing her PhD, she spent two years as a post-doctoral researcher at the Université Côte d'Azur (Nice, France) and two years as a Research Professor at Northwestern University. She joined the faculty at Michigan State in August 2019.