UNIVERSITY OF DELAWARE

CHEMICAL & BIOMOLECULAR ENGINEERING

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MULTISCALE CONTROL OF DYNAMIC HYDROGELS FOR BIOINSPIRED APPLICATIONS

MAY 10 | 10:15 AM | 102 COLBURN LAB

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Attend virtually: https://udel.zoom.us/j/91386404306

Transient polymer networks are found throughout biological systems, both intracellularly and extracellularly. Hydrogels with dynamic linkers have garnered intense interest as extracellular matrix (ECM) mimics and injectable delivery vehicles due to their tailorable viscoelasticity, stress relaxation, and self-healing behavior. However, to fully enable these applications, there remains a need to understand how linking chemistry affects gelation and nonlinear rheological properties. In this context, we have developed synthetic multi-arm poly(ethylene glycol) (PEG) hydrogels with three different dynamic covalent linking chemistries. This suite of dynamic covalent linkages allows control over the bond exchange kinetics across three orders of magnitude, which dictates hydrogel viscoelasticity under small amplitude oscillatory shear. Interestingly, the hydrogel moduli demonstrate unique scaling behavior at low concentrations, indicating heterogeneous networks. Furthermore, they exhibit non-monotonic flow curves under steady shear, with shear thickening behavior that depends on the crosslinking bond exchange kinetics and polymer concentration. At high shear, the dynamic hydrogels are injectable, with faster bond exchange kinetics leading to lower injection forces. Overall, these results provide insight to the molecular and structural characteristics that govern dynamic covalent PEG gelation, mechanics, and flow, while also expanding the types of scaffolds applicable to tissue engineering and therapeutic delivery.

ABOUT THE SPEAKER

Adrianne Rosales is an Assistant Professor of Chemical Engineering at the University of Texas at Austin. She is a co-lead of the Interdisciplinary Research Group "Fuel-Driven Pluripotent Materials" in UT Austin's Materials Research Science and Engineering Center. She received her B.S. in Chemical Engineering from UT Austin and obtained her Ph.D. in Chemical Engineering from UC-Berkeley. After completing her Ph.D. in 2013, she trained at the University of Colorado Boulder as an NIH NRSA post-doctoral fellow. Adrianne's group at UT Austin focuses on the development of bioinspired polymeric materials to model cellular microenvironments and engineer therapeutic technologies. This work has been supported by a Burroughs Wellcome Fund Career Award at the Scientific Interfaces, an NIH Early Stage Investigators Maximizing Investigators' Research Award, and an NSF CAREER Award. This work has also been recognized by the American Chemical Society Polymeric Materials: Science and Engineering Division, a 3M Non-Tenured Faculty Award, and the journal *ACS Polymers Au*.

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