CHEMICAL & BIOMEDICAL ENGINEERING GRAD STUDENT SEMINAR

Multiscale Control of Dynamic Hydrogels for Bioinspired Applications

Friday, November 6
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COE B221



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ABSTRACT: 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 either 1) dynamic covalent or 2) hierarchically structured crosslinkers. First, dynamic covalent linkages allow control over the bond exchange kinetics, which dictates hydrogel viscoelasticity under small amplitude oscillatory shear. At dilute concentrations, where the hydrogels are injectable, the networks exhibit shear thickening behavior that suggests chain stretching and a defect-rich network structure. Second, we designed hierarchically structured crosslinkers for hydrogels using peptoids, or N-substituted glycines. Helical peptoids increased the shear moduli of hydrogels due to increased chain stiffness as compared to non-helical peptoids, while keeping hydrogel network connectivity and swelling ratio fixed. Overall, this work suggests new strategies to control engineered ECM mechanics with constituent polymer structure.

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