Tunable rheology of mixed hydrogels with different interactions

Presenters

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Abstract

Hydrogels with tunable mechanical response and physiological properties have huge potential in biomedical, environmental and engineering applications. The challenge is to synthesize materials with high water uptake without sacrificing the strength and resilience of the network along with dynamic physical interactions that promote processability and self-healing. We have focused on the unusual rheological properties of a class of hydrogels made of fibrilar supramolecular assemblies based on hydrogen-bonding units, which form physical networks akin to entangled polymers, and gel-like structures made of telechelic moeties, which exhibit different mechanical response. We find that, by mixing these distinct moeties in different compositions a non-monotonic, non-additive mechanical response is obtained, suggesting additional interactions between the two components that enable fine tuning the mechanical properties. We analyze the gel rheology using a combination of experiments (rheology and microscopy) and numerical simulations. The simulations comprise networks made of two building units with different interaction strengths and capture the non-monotonicity of the mechanical properties, providing new insight into the possible mechanisms underpinning the tunability of the hydrogel response. Therefore, a powerful toolbox for tailoring the rheology of supramolecular hydrogels emerges.