Polymer Program

2021 Fall Webinar Series

Friday, September 10, 11:10 am

Webex Link: https://uconn-cmr.webex.com/uconn-cmr/j.php?MTID=m9f6885dacb1d19da4f40e952cd67c15f

"Bio-like Structural Hydrogels with Life-like Intelligence"

Prof. Ximin He

University of California, Los Angeles

Abstract: From the cellular level up to the body system level, living organisms present elegant designs and strategies to realize the desirable structures, properties and functions. For example, tendons and muscles are tough but soft, owing to highly complex hierarchical structures rarely found in synthetic materials. Plants can automatically track the sun and our body can self-regulate motions adaptively to environment, presenting superior intelligence also lacking in manmade systems. Hydrogels, as a class of crosslinked polymers, not only have tissue-like water-rich porous networks and can also change their volume and physical properties in response to environmental cues including temperature, light, and specific molecules. At UCLA He lab, we exploit fundamental material processing-structure-property-function studies of hydrogels and their derivatives, to create (i) 'bio-like' structures and properties and (ii) 'life-like' intelligence in functional soft materials for applications in robotics, biomedicine, energy and environment. In this talk, I will start with showcasing how the stimuli-responsiveness of hydrogels can unify sensing-diagnosis-actuation process to create 'synthetic intelligence' with built-in feedback loop, such as sunflower-like light tracking for solar harvesting (*Nat. Nanotech.* 2019) and self-sensing actuators for autonomous soft robotics (*Sci. Robotics* 2019, 2021; *Matter* 2021). Driven by the remaining challenges revealed in these function developments, I will then present our structural material approaches to breaking the fundamental limits in mechanical, diffusion and electrical properties. I will discuss the mechanics and general principles to design extreme properties, including simultaneously high toughness and stretchability (*Nature* 2021; *Adv. Mater.* 2021; *Sci. Adv.* 2020), tunable porosity and diffusivity (*Adv. Mater.* 2021; *EcoMat* 2021) and stretchable conductive soft materials for flexible (bio) electronics (*Matter*, 2020; *Adv. Funct. Mater.* 2020; *Adv. Mater.* 2019), as well as anti-icing coating (*PNAS*, 2020, 2021; *Matter* 2019). If time permits, recent progress on 3D/4D printing may be discussed as well. I will conclude my talk with a perspective on future human-machine convergence enabled by soft materials.

Home page: http://www.seas.ucla.edu/xhe-lab/

For more information, please contact Osker Dahabsu at osker@uconn.edu