NORTHWESTERN UNIVERSITY'S DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING PRESENTS:

2021 MSE SPRING SEMINAR SERIES

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Ximin He is an assistant professor of Materials Science and Engineering at University of California, Los Angeles (UCLA) and Faculty of California Nanosystems Institute (CNSI). Dr. He was postdoctoral research fellow in Wyss Institute of Bioinspired Engineering and School of Engineering and Applied Science at Harvard University. Dr. He received her PhD in Chemistry from University of Cambridge. Dr. He's research focuses on bioinspired soft materials, structural polymers and their physical, mechanical, electrical and photothermal properties with broad applications in biomedicine, energy, environment and robotics. Dr. He is the recipient of the National Science Foundation CAREER award, Air Force Office of Scientific Research Young Investigator Program (AFOSR YIP) award, CIFAR Global Scholar, International Society of Bionic Engineering (ISBE) Outstanding Youth Award, Society of Engineering Science (SES) Young Investigator Medal, 3M Non-tenured Faculty Award, Hellman Fellows Award, and UCLA Faculty Career Development Award. Her research on bioinspired tough hydrogels, phototropic, phototaxic, homeostatic and anti-icing materials have garnered a number of regional and international awards and was featured in >100 international news outlets.

Bio-like Structural Hydrogels with Life-like Intelligence

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.

Thursday, April 15 • 4 PM CDT • Zoom

Registration is required. RSVP link.

Questions? Contact Kristina.lugo@northwestern.edu.

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