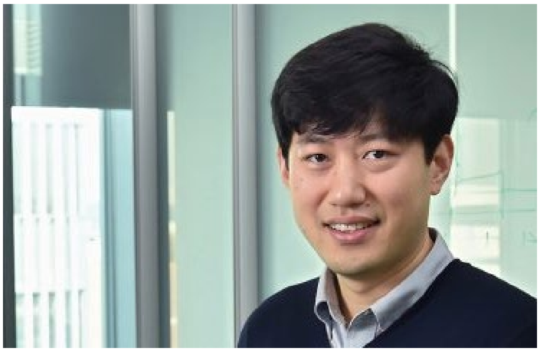
iCeMS Kitagawa Group Seminar



Assoc. Prof. Xi Chen

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Short Bio Xi Chen is an Associate Professor in the Nanoscience Initiative at the CUNY Advanced Science Research Center (ASRC) and the Department of Chemical Engineering at the City College of New York. He grew up in China and earned his B.S. and M.S. degrees from Tsinghua University, followed by a Ph.D. from Stevens Institute of Technology. Chen then completed a postdoc in Biological Sciences at Columbia University. Chen is recognized as a leader in hygroscopic materials by Blavatnik Regional Awards for Young Scientists and the NSF CAREER Award. He also serves as a World Economic Forum Expert in Future of Energy and Water. His current research focuses on deciphering powerful and efficient evaporation-induced mechanical deformations in biological systems and replicating these mechanisms outside the biological context for application in evaporation-powered locomotion, green chemistry, and electricity generation.

Biomimetic water-responsive crystals as high-energy actuators

Date: October 3, 2023
Time: 13:30-14:30
Place: iCeMS Main Bldg.
4F Meeting Room

You can join this lecture by ZOOM by registering through this link (scan or click)

ABSTRACT: In nature, plants have developed water-responsive (WR) materials that mechanically deform in response to changes in relative humidity. These WR materials can harness evaporation and convert it into forces or locomotion that drive plants' essential tasks, such as pinecones that open and release pine seeds when the environment is dry. Several of these mechanically robust, yet flexible structures can actuate more powerfully than existing actuators and muscles and they hold promise as efficient actuators for energy harvesting, adaptive structures, and soft robotics. Inspired by nature, we have developed a new class of peptide WR crystals that reversibly change their lattice structures in response to humidity changes. The work enables the use of powerful crystallographic methods and simulations to probe molecular level energy conversion in a way that was not possible before. While studying these peptide-based crystals with hierarchical structures and aqueous pores, we found that only the crystals with water bonding strengthening upon dehydration show strong water-responsiveness. Our observations suggest that dehydration-induced hydrogen bonding strengthening efficiently transfers pressure and volume changes induced by water desorption to deform surrounding stiff and ductile structures, providing insight into general mechanisms of high-performance WR actuation. Moreover, the best-performing crystal emerges as an efficient, powerful WR material for applications at scale and low cost.