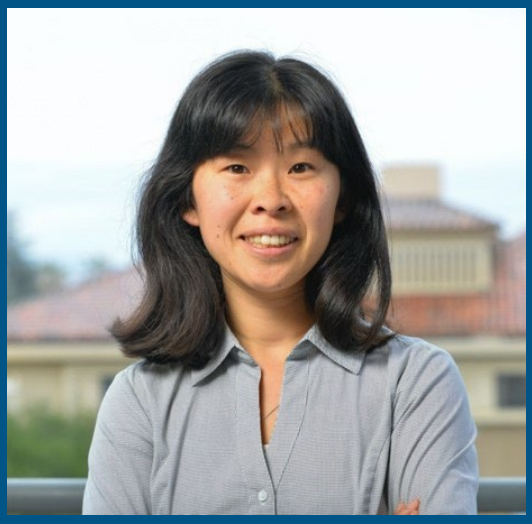
UCLA Samueli School of Engineering

Mechanical & Aerospace Engineering
Departmental Seminar

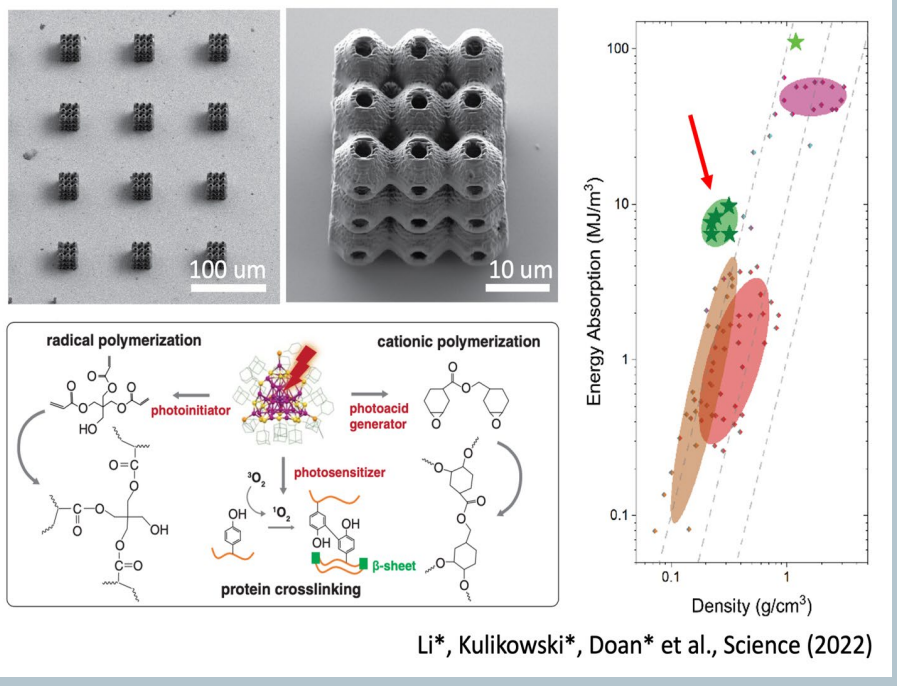


Friday, May 12, 2023 12 PM – 1 PM
Klug Memorial 8500 Boelter Hall

Composite Nanolattices and Colloidal Self-Assembly Enabled by 3D Nanoprinting

Wendy Gu
Associate Professor
Mechanical Engineering
Stanford University

ABSTRACT: 3D nanoprinting is a frontier for many fields, from micro-robotics to energy devices to medicine. Yet, current methods are generally limited to homogeneous polymers, metals or ceramics that lack the complexity of structural engineering materials. In addition, most efforts have focused on the fabrication of static structures, despite significant interest in active, programmable matter such as colloidal crystals that can transform into additional structures. First, I will present a novel two-photon lithography resin that is used to print nanocomposites, nanoporous carbon and nanostructured silk. The key ingredients in the resin are metallic nanoclusters that serve as both photoinitiators and inorganic precursors, and have pressure-dependent optical properties. Nanocomposite honeycomb, octet and shell-based lattices are fabricated that have a combination of high strength per weight, energy absorption and recoverability beyond other nano and micro-lattices due to a unique strain hardening behavior. In the second part of my talk, I will discuss the two-photon lithography of polyhedral colloidal microparticles that self-assemble into a 2D hcp crystal, and then undergoes a solid-solid phase transition into a quasi-diamond structure under a gravitational potential. Direct optical imaging of this phase transition reveals the single particle dynamics, including the role of particle rotation and crystalline defects, which is also explored using Monte Carlo simulations.



Li*, Kulikowski*, Doan* et al., Science (2022)

BIO: Wendy Gu has been an Assistant Professor of Mechanical Engineering at Stanford University since 2017. Before this, Wendy received her MS/PhD from Caltech in 2014, and was a postdoc at UC Berkeley from 2015-2017. Her research focuses on lightweight architected materials, nanostructured metals and structural alloys, design and mechanics of energy materials (batteries, hydrogen economy, soft magnetic composites), and materials for extreme environments (e.g. high pressure). Major techniques within the group include nano-mechanical testing and in-situ imaging using transmission and scanning electron microscopy, synchrotron X-ray diffraction and imaging nano-synthesis and self-assembly, and 3D printing. Wendy is the recipient of the DOE Early Career Award, the ARO Young Investigator Award, the ACS Petroleum Research Fund Doctoral New Investigator Award, and the Hellman Scholar Award.

Pizza will be served

Host: Jonathan Hopkins, MAE, hopkins@seas.ucla.edu