THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT FALL COLLOQUIUM SERIES PRESENTS:

Julia Greer

Professor, Materials Science, Mechanics, and Medical Engineering

California Institute of Technology

Materials by Design: Three-Dimensional (3D) Nano-Architected Meta-Materials

Creation of extremely strong and simultaneously ultra lightweight materials can be achieved by incorporating architecture into material design. In our research, we design and fabricate three-dimensional (3D) nano-architected materials that can exhibit superior and often tunable thermal, photonic, electrochemical, biochemical, and mechanical properties at extremely low mass densities (lighter than aerogels), which renders them useful, and often enabling, in many technological applications. Dominant properties of such meta-materials are driven by their multi-scale nature: from characteristic material microstructure (atoms) to individual constituents (nanometers) to structural components (microns) to overall architectures (millimeters and above). Our research is focused on fabrication and synthesis of nano- and micro-architected materials using 3D lithography, nanofabrication, and additive manufacturing (AM) techniques, as well as on investigating their mechanical, biochemical, electrochemical, electromechanical, and thermal properties as a function of architecture, constituent materials, and microstructural detail. The focus of this talk is on additive manufacturing via function-containing chemical synthesis to create 3D nano- and micro-architected metals, ceramics, multifunctional metal oxides (nano-photonics, photocatalytic, piezoelectric, etc.), shape memory polymers, etc., as well as demonstrate their potential in some real-use biomedical, protective, and sensing applications. I will describe how the choice of architecture, material, and external stimulus can elicit stimulus-responsive, reconfigurable, and multifunctional response.

Julia Greer is a Ruben F. and Donna Mettler Professor of Materials Science, Mechanics, and Medical Engineering and the Director of the Kavli Nanoscience Institute at Caltech. Greer's research focuses on creating and characterizing classes of materials with multiscale microstructural hierarchy, which combine three-dimensional (3D) architectures with nanoscale-induced material properties. Greer has more than 150 publications (h-index 62) and has delivered over 100 invited lectures, which include 2 TEDx talks, multiple plenary lectures and named seminars at universities, Watson lecture at Caltech, Gilbreth Lecture at the National Academy of Engineering, Midwest Mechanics Lecture series, and "IdeasLab" at the World Economic Forum, and was recently selected as a Cruickshank Lecturer at the Gordon Research Conferences (2020). She received the inaugural AAAFM-Heeger Award (2019) and was named a Vannevar-Bush Faculty Fellow by the US Department of Defense (2016) and CNN's 20/20 Visionary (2016). Her work was recognized among Top-10 Breakthrough Technologies by MIT's Technology Review (2015). Greer was named as one of "100 Most Creative People" by *Fast Company* and a Young Global Leader by World Economic Forum (2014) and received multiple career awards: Kavli (2014), Nano Letters, SES, and TMS (2013); NASA, ASME (2012), Popular Mechanics Breakthrough Award (2012), DOE (2011), DARPA (2009), and Technology Review's TR-35, (2008). Greer serves on the Board of Directors for Azul 3D and is an Associate Editor for *Nano Letters*. She is also a concert pianist.

Thursday, October 7 • 4 pm CT • Zoom

Registration is required. RSVP here.

Questions? Contact elena.lindstrom@northwestern.edu.

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