

School of Sustainable Engineering and the Built Environment



Chenglin Wu, PhD

Assistant Professor

Civil, Architectural, and Environmental Engineering

Missouri University of Science and Technology

Tuesday, March 22, 2022

1:30-2:30pm

College Avenue Commons (CAVC) 335

From Nano to Macro: Manufacturing Next-Generation Intelligent and Resilient Materials and Structures

ABSTRACT: The rapid growth of the modern world demands next generation intelligent materials and structures to be smart, self-reliable, efficient, and durable. In the past decade, nanomaterials, including 1D and 2D materials, have become the most prominent candidates since they often exhibit superior electro-chemo-mechanical properties in comparison with their bulk counterparts. In addition, with the help of advanced electron imaging technologies, we can investigate their structural-to-property relationships at atomic scale and engineer them through bottom-up approaches. These advantages allow us to manufacture multi-functional composite materials for superior mechanical strength, energy storage, electro-chemical, bio-sensing, self-actuated robots, and lightweight structures.

In this talk, I will present out recent work in the following areas: (1) Synthesis and characterization of low dimensional functional materials including graphene, MXene, and nano wires. We utilized the AFM, nanoindentation, push-to-pull MEMS device, and laser-induced projectile impact test to conduct nanomechanics investigations to understand the fundamental structure-to-property relationship of low dimensional functional materials and their composites. (2) Advanced electro-chemical-optical sensors and intelligent systems. We have developed advanced transfer method to fabricate nano-scale fiber-optic corrosion sensors, wireless long-range strain sensors, as well as on-mask SARS-CoV-2 and influenza virus sensors utilizing the functional low-dimensional materials. (3) Multi-scale and multi-physics modeling. To understand some fundamental physical problems, we have also developed the phase-field methods to investigate

multi-scale and multi-physical fracture problems. (4) Machine learning material discovery, and system design. To satisfy the design needs, we have built a robotic mechanician to perform material characterization and computationally aided design approaches. (5) 3D printing infrastructure. We have developed unique printing approaches that can print soft robots and reinforced concrete structures, where the interfacial mechanics are critical to the performances of the printed robots and structures.

BIOSKETCH: Asst. Prof. Chenglin Wu received his bachelor's degree in civil engineering from Tongji University in 2006 and his PhD degree in Civil, Architectural, and Environmental Engineering from Missouri S&T in 2014. He obtained his second PhD in Engineering Mechanics in 2016 from the Department of Aerospace Engineering and Engineering Mechanics, at UT-Austin. Dr. Wu joined the Department of Civil, Architectural, and Environmental Engineering at Missouri S&T in spring 2017. Dr. Wu received the NSF CAREER Award in 2021.

Dr. Wu's research interests focus on nanomaterials, mechanics, and advanced manufacturing with a particular emphasis on materials and structures at different dimensions (from macro to nano scales) and having multi-physics related problems. His research is motivated by practical applications in civil, mechanical, geo-mechanical, microelectronics, micro-electromechanical systems (MEMS), emerging nano/biotechnologies, and robotics.