UCMERCED UNIVERSITY OF CALIFORNIA Graduate MECHANICAL ENGINEERING

Fall 2021 Graduate Seminar

Mechanically-coupled Properties in Van der Waals Materials

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Friday, October 29th, 2021; 2:00-3:00 pm; Location: CLSSRM 110

Abstract

Many mechanical deformations, such as buckling, crumpling, wrinkling, collapsing, and delamination, are usually considered as threats to mechanical integrity and are avoided or reduced in the traditional design of materials and structures. My work goes against these conventions by tailoring such mechanical instabilities to create new functional morphologies. We use ultralow bending stiffness and semiconducting properties of atomically-thin van der Waals (vdW) materials to enable emerging mechanically-coupled properties and device-level multi-functionalities that extend beyond those of bulk material systems. In this talk, I will present our research on controlled deformation and interfacial control of two-dimensional (2D) vdW materials, and the new and reconfigurable materials properties exhibited in such deformed and heterogeneously layered materials. First, I will introduce controlled mechanical deformation of 2D materials, and the wide range of new properties engendered by these deformed materials, such as strain-induced exciton transport. Furthermore, I will present our work on interfacial control using vdW materials to modulate fracture modes of thinfilms to enable a new phenomenon of 'electrical ductility'. These mechanical instability-induced modulations of materials at the atomic level will open the door to new phases of matter with unconventional and reconfigurable properties for applications in next generation deformable electronics and quantum devices.

Biography

Dr. SungWoo Nam is an Associate Professor in the Department of Mechanical and Aerospace Engineering at University of California, Irvine. His research interest is at the intersection of materials, mechanics and multifunctionality, where he focuses on understanding mechanically coupled properties in low-dimensional materials and building devices based on advanced materials. He earned a bachelor's degree in materials science and engineering from Seoul National University, where he graduated as valedictorian from the College of Engineering. Following three years of industry experience, he completed a master's degree in physics (2007) and a doctorate in applied physics (2011) from Harvard University. He then worked as a postdoctoral scholar at University of California, Berkeley. Between 2012-2021, he was an associate professor and the Anderson Faculty Scholar in the Department of Mechanical Science and Engineering at University of Illinois at Urbana-Champaign (UIUC). He is a recipient of The Minerals, Metals and Materials Society Early Career Faculty Fellow Award, NSF CAREER Award, AFOSR and ONR Young Investigator Program Awards, NASA Early Career Faculty Award, UIUC Center for Advanced Study Fellowship, UIUC Campus Distinguished Promotion Award, UIUC Engineering Dean's Award for Excellence in Research, UIUC Engineering Rose Award for Teaching Excellence, and UIUC Engineering Council Award for Excellence in Advising.

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