

PROFESSOR SUNGWOON NAM



ARCHITECTURING ATOMICALLY-THIN MATERIALS FOR MULTIFUNCTIONALITY

ABSTRACT

Materials with designed structural features, such as layers, crumples, folds or ridges (i.e., architected materials), are rapidly emerging as an exciting class of materials with new, adaptive, and multifunctional properties. The limitless combinations of design and control of structural features in materials enable the reconfigurable programming and integration of optical, thermal, electrical and mechanical functionalities. Atomically-thin material systems, such as graphene and transition metal dichalcogenide monolayers, have proven to be particularly attractive subject materials for architecting due to their unique intrinsic properties, stackable nature, and ultralow bending stiffness. Mechanically controlled architecting of atomically-thin materials allows new structural properties and device-level functionalities which surpass the limits of bulk material systems. In this talk, I will present our nano-manufacturing techniques in controlling deformation and straining of atomically-thin materials, and introduce the new and reconfigurable materials properties and applications of such deformed and strained materials. First, I will introduce shrink-manufacturing approaches to enabling controlled deformation of atomically-thin materials. Second, I will introduce a wide range of new functionalities of these architected materials, such as shape-induced plasmonic resonance and strain-induced exciton funnelling and flexoelectricity. Third, I will present our work on adaptive and multifunctional devices based on architected atomically-thin materials. Finally, I will share our vision for manufacturing and integration of architected constituents toward layered, multi-dimensional systems. Our approach to designing and manufacturing architected atomically-thin materials offers a unique avenue for enabling new materials properties and engineering of advanced device functions.

BIOGRAPHY

Dr. SungWoo Nam is an Associate Professor in the Department of Mechanical Science and Engineering at University of Illinois at Urbana-Champaign (UIUC). He received his M.A. in Physics (2007) and Ph.D. in Applied Physics (2011) from Harvard University. After his Ph.D., he worked as a postdoctoral research associate at University of California, Berkeley. His research program pursues innovations in controlled deformation (i.e., 'architected') of atomically-thin, two-dimensional (2D) materials and explores how unique shapes of atomically-thin materials enable mechanically reconfigurable functionalities and devices. Dr. Nam is the recipient of the The Minerals, Metals and Materials Society (TMS) Early Career Faculty Fellow Award, NSF CAREER Award, AFOSR and ONR Young Investigator Program (YIP) Awards, NASA Early Career Faculty (ECF) Award, American Chemical Society (ACS) Petroleum Research Fund Doctoral New Investigator Award, 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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