UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UC SAN DIEGO NANOENGINEERING SEMINAR

Wednesday, November 28, 2018
Seminar Presentation: 11:00am – 12:00pm
SME 248

"Mechanics of Low Dimensional Materials – Experiments and Modeling"

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Abstract: In the past decade, there has been a major thrust to synthesize low dimensional materials exhibiting unique and outstanding physical properties. These nanomaterials are envisioned as building blocks for the next generation of lightweight materials, electronics, sensors, and energy systems. In these applications, identification of size and time dependent mechanical properties is essential. However, such endeavor has proven challenging from both experimental and modeling perspectives. In this presentation, progress in nanoscale mechanical experimentation and modeling, towards accurate identification of deformation and failure of *nanomaterials* will be discussed. Two case studies will be examined. In the first one, the plasticity and time dependent failure of silver nanowires will be explored by means of *in situ* electron microscopy testing and molecular modeling. We will show that silver nanowires are very strong and exhibit unusual deformation modes arising from high surface to volume ratios. Interestingly, we will also show that the same feature can lead to stress-driven atomic surface diffusion, resulting in time dependent failure instabilities under constant strain conditions. In a second case study, we will discuss the mechanical properties of graphene oxide, a material presenting functional groups ideal for membrane filtration films and synthesis of multilayer nanocomposites. The effect of chemical functional group type and density on monolayer toughness, stiffness, and strength will be ascertained using a combination of nanomechanical experiments and molecular modeling. Pathways for achieving a several-fold increase in the toughness of graphene oxide monolayers will be examined.

Biosketch: Dr. Horacio D. Espinosa is the James and Nancy Farley Professor of Manufacturing and Entrepreneurship, Professor of Mechanical Engineering, Director of the Institute for Cellular Engineering Technologies, and Director of the Theoretical and Applied Mechanics Program at the McCormick School of Engineering and Applied Sciences at Northwestern University. He received his Ph.D. in Solid Mechanics from Brown University. Professor Espinosa has made contributions in the areas of dynamic failure of advanced materials, micro, and nanomechanics. He is a foreign member of the European Academy of Arts and Sciences, the Russian Academy of Engineering, and *Fellow* of AAAS, AAM, ASME, and SEM. He received numerous awards and honors including the ASME THURSTON award, and the Society for Experimental Mechanics MURRAY, LAZAN, HETENYI and SIA NEMAT-NASSER awards. He was the Timoshenko visiting Professor at Stanford University in 2011, President of the Society of Engineering Science in 2012, and served from 2013-2016 in the ARL Panel on Materials Science and Engineering. Currently he serves in a committee of the National Academies, U.S. National Committee on TAM and the IUTAM Congress Committee.