# MECHANICAL ENGINEERING COLLOQUIUM
# FALL 2009 SERIES

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1 – 2:30 p.m.

Room MEC 224


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## Energy Conversion using Nanoporous Materials and Functional Liquids


When a liquid phase, whose motion is controlled by pressure, voltage, and/or heat, is confined in a nanoporous material, the ultra-large pore surface area exposed to the liquid becomes an ideal platform for energy conversion, including energy harvesting (convert mechanical or thermal energy into electricity), energy absorption (convert mechanical energy into heat and interface energy) and actuation (convert thermal or electrical energy into mechanical output). The energy conversion density is orders-of-magnitude higher than that of conventional materials. The design and optimization of the multifunctional nanocomposite material (with nanoporous matrix and functional liquid filler) are underpinned by the science of nanofluidics, a wide open area where solid mechanics and fluid mechanics meet at the small scale. At the nanoscale, owing to the counterintuitive behaviors of the confined liquid molecules and ions, as well as their unique interaction characteristics with the solid atoms, many conventional fluid mechanics laws break down and new nanofluidic theories are established based on atomistic simulations. The multiscale studies also provide critical insights for improving the energy conversion processes, and the novel nanoporous materials developed herein become very attractive as the building blocks of the next-generation multifunctional systems, with high-performance self-protective, self-powered, and self-actuated functionalities.


Dr. Xi Chen received his Ph.D. in Solid Mechanics from Harvard University in 2001, and was a postdoctoral fellow from 2001-2003. He joined Columbia University in Fall 2003 and was promoted to an Associate Professor in 2006. He uses multiscale theoretical, experimental, and numerical approaches to investigate various research frontiers in materials addressing challenges in energy and environment, nanomechanics, and mechanobiology. He has published over 130 journal papers with an H-index over 21. He received the National Science Foundation (NSF) CAREER Award in 2007, the Presidential Early Career Award for Scientists and Engineers (PECASE) in 2008 (nominated by NSF), and Outstanding Oversea Young Investigator Award from Chinese National Science Foundation in 2009. He is a member of the American Academy of Mechanics (AAM), the American Society of Mechanical Engineers (ASME), the American Society of Civil Engineers (ASCE), and the Materials Research Society (MRS). He chairs the Multifunctional Materials Technical Committee of the ASME.