

# FRONTIERS IN MATERIALS SCIENCE SEMINAR

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## Nanogenerators and Nanopiezotronics

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Developing novel technologies for wireless nanodevices and nanosystems are of critical importance for sensing, medical science, defense technology and even personal electronics. It is highly desired for wireless devices and even required for implanted biomedical devices to be self-powered without using battery. Therefore, it is essential to explore innovative nanotechnologies for converting mechanical energy (such as body movement, muscle stretching), vibration energy (such as acoustic/ultrasonic wave), and hydraulic energy (such as body fluid and blood flow) into electric energy that will be used to power nanodevices without using battery. We have demonstrated an innovative approach for converting nano-scale mechanical energy into electric energy by piezoelectric zinc oxide nanowire (NW) arrays. The operation mechanism of the electric generator relies on the unique coupling of piezoelectric and semiconducting dual properties of ZnO as well as the elegant rectifying function of the Schottky barrier formed between the metal tip and the NW. Based on this mechanism, we have recently developed DC nanogenerator driven by ultrasonic wave in bio-fluid. We have also used textile fibers for energy harvesting. This presentation will introduce the fundamental principle of nanogenerator and its potential applications. Finally, a new field on nanopiezotronics is introduced, which uses piezoelectric-semiconducting coupled property for fabricating novel and unique electronic devices and components.

Dr. Wang is a Regents' Professor and COE Distinguished Professor at Georgia Tech. He has authored and co-authored four scientific references and textbooks, published over 550 peer reviewed journal articles, 55 review papers and book chapters, edited and co-edited 14 volumes of books on nanotechnology, and held 20 patents and provisional patents. Dr. Wang is the world's top 25 most cited authors in nanotechnology from 1992-2002 (*ISI, Science Watch*). His entire publications have been cited for over 25,000 times. The H-index of his publications is 76. He is a fellow of American Physical Society and fellow of AAAS, and he has received the 2001 S.T. Li prize for Outstanding Contribution in Nanoscience and Nanotechnology, the 2000 and 2005 Georgia Tech Outstanding Faculty Research Author Awards, Sigma Xi 2005 sustain research awards, and the 1999 Burton Medal from Microscopy Society of America.