Stevens Institute of Technology

Nanotechnology Graduate Program

Active Polymer Nanocomposites: Towards Enhanced Sensing and Actuation Performance

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[note room change] **Carnegie 315, Time *NOON*** ***[note room change]***

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Electroactive polymers (EAPs) have gained notoriety as a valuable class of smart materials. Polymers offer the advantage of processing flexibility, lightweight, and durability. Other notable features of polymers include their low dielectric constant, low elastic stiffness, and low density, which may result in a high voltage sensitivity (good sensor characteristics) and low acoustic and mechanical impedance (crucial for medical and underwater applications). Shortfalls of current EAPs include relatively small electromechanical coupling coefficient, high actuation voltage and poor blocked stress. We are exploring nanocomposite concepts to address these materials limitations and enhance the electroactive response of polymers. Our goal is to judiciously control nanoparticle dispersion, distribution, and interfacial interactions to develop polymer nanocomposites with inherent electromechanical coupling. Stable solutions of nanoparticles combined with a series of polymers are prepared and processed into various forms such as films, fibers, and non-woven mats. Our results indicate that the interface between the nanoparticles and the polymers is a key factor in the observed electromechanical response. Better wetting and interaction between nanoparticle and polar polymers compared to non-polar ones is considered the primary reason for enhanced actuation response in these nanocomposites. We further address the issue of nanoparticle dispersion and distribution by implementing electric field micro-tailoring of carbon nanotubes in liquid and solid polymers. The anticipated outcome is the development of lightweight, *active* structural polymer nanocomposites with unique combinations of mechanical, electrical, and coupled properties for use in lightening strike mitigation, EMI shielding, structural health monitoring, and energy harvesting.

Zoubeida Ounaies, is an assistant professor in the Department of Aerospace Engineering at TAMU. At TAMU, she has established the Electroactive Materials Characterization Laboratory (EMCL), an experimental research facility dedicated to the processing and characterization of materials that combine structural integrity with the ability to sense or actuate in response to an electric field. She joined the Department of Aerospace Engineering at TAMU in 2005, and has recently been awarded the Texas Space Grant New Investigators Program Award (2006) and the NSF CAREER Award (2007). Her research is supported by NSF, AFOSR, NASA and DARPA.

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