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Biointerfaced Nanodevices

Wednesday, January 16, 2013
2:15 p.m.
101 Goergen Hall

The development of a method for interfacing high performance devices with flexible, stretchable, and biocompatible materials could yield breakthroughs in implantable or wearable systems. Yet, most high quality materials are hard or rigid in nature, and the crystallization of these materials generally requires high temperatures for maximally efficient performance. These properties render the corresponding devices incompatible with temperature-sensitive soft materials such as plastic, rubber, and tissue. Nanotechnology provides a route for overcoming these dichotomies, by altering the mechanics of materials while simultaneously improving their performance. In this talk, I will focus on two vital areas for interfacing nanodevices with soft materials: 1) graphene nanosensors for bacteria detection, and 2) piezoelectric PZT nanoribbons for bioelectromechanical sensing. Our approach in both cases involves the following key steps: first, nanomaterial synthesis or fabrication; second, fundamental studies of the effect of scaling on nanomaterial properties; third, integration into high performance devices; and finally, interfacing these materials with soft substrates. The enhanced performance of nanomaterials coupled with “living” platforms may enable exciting avenues in fundamental research and novel applications, including on-body threat detection and energy harvesting.