STEVENS INSTITUTE of TECHNOLOGY
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Soft and Fuzzy Conjugated Polymers for Interfacing Bionic Devices with Living Tissue

Professor David C. Martin

Karl and Renate Böer Professor and Chair of Materials Science
University of Delaware

ABSTRACT

A number of implantable biomedical devices that are in clinical use or in active development involve the direct integration of solid inorganic metallic or semiconducting electrodes with living tissue. In all of these devices it is important to establish and maintain effective communication between the soft, wet, ionically conducting cells and the hard, dry, electrically conducting engineered device. We are developing methods for using conjugated polymers such as PEDOT and PProDOT to help improve the performance of biomedical devices. These polymers can be electrochemically deposited onto a metal electrode to a thickness that can be precisely determined and controlled. The morphology can be tailored by adding certain polymeric counterions during deposition, creating a high surface area structure that significantly reduces the total impedance of the coating. This fuzzy structure also creasts a soft mechanical interface with living cells. The high surface area morphology facilitates efficient and rapid charge exchange between the electrode and the ionically conductive tissue. We have shown that precisely defined polymer microstructures can be created by polymerizing through and around dissolvable templates such as spheres or nanofibers. We have also shown that the polymerizations of these materials can be done in the presence of living cells, both in-vitro and in-vivo, while functionalized versions of the EDOT and ProDOT monomers can be used to attach peptides or other molecules with specific biological functionalities. We have also shown that certain functionalized indoles can also be electrochemically deposited, creating new materials with chemistries that are similar to the natural biomolecule melanin. Some of our synthetic melanin derivatives have shown different colors (such as green instead of the usual brown or black), and are electrochromic.

BIOGRAPHY

David C. Martin is the Karl and Renate Böer Professor and Chair of Materials Science and Engineering at the University of Delaware. He is a Fellow of the American Physical Society and the American Institute of Medical and Biological Engineering. His research interests focus on the molecular design, synthesis, and physical characterization of conjugated polymers for interfacing bionic devices with tissue, and high resolution structural characterization of defects in semiconducting polymers and organic molecular solids.

EVENT DETAILS

DATE:
Wednesday Oct. 17, 2012

TIME:
11:00 AM

LOCATION:
Babbio Center, Room 122
Stevens Institute of Technology

ATTENDANCE:
This event is open to Stevens' Faculty, Students, Staff, and Invited Guests

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