Design, Synthesis, and Characterization of Conjugated Polythiophenes for Interfacing Electronic Biomedical Devices with Living Tissue

David C. Martin

Materials Science and Engineering and Biomedical Engineering, The University of Delaware, USA
milty@udel.edu

We have been exploring the use of chemical stable, electronically and ionically active polythiophenes for interfacing rigid, inorganic metallic and semiconducting biomedical devices with soft, organic, and wet living tissue[1]. Functionalized thiophene comonomers such as EDOT-acid and ProDOT-diene, shown in the schematic, make it possible to tailor the charge transport, mechanical properties, and biological activity of the resulting copolymers. Examples of targeted electronic devices include pacemakers, cochlear implants, retinal prostheses, cortical electrodes, and cardiac mapping devices. Recent efforts have focused on the use of carboxylic-acid and amine-functionalized monomers for improving interactions with adhesion to solid substrates, and multifunctional molecules for introducing covalent chemical crosslinking. The polymers are typically deposited from solution using oxidative electrochemical methods. The physical and chemical properties of the resulting films are characterized using a variety of methods including impedance spectroscopy, FTIR and Raman spectroscopy, optical microscopy, and electron microscopy.

This work was supported by the National Institutes of Health (NINDS-N01-NS-1-2338, 1R01EB010892), the Defense Advanced Research Projects Agency (N660011-11-C-4190), the Army Research Office (MURI W911NF-06-1-0218), the National Science Foundation (DMR-1103027), and the University of Delaware.

[1]David C. Martin, MRS Communications, 5(2), 131-153, (2015).