

UNH Materials Science Seminar

11:00-12:00, Thursday, March 30, 2006

DeMeritt Hall 209B

University of New Hampshire

Oligothiophene Interfaces and Organic Electronic Devices

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Oligo- and polythiophenes comprise an important class of semiconducting molecules with a variety of organic electronic device applications, including light-emitting diodes, photovoltaics, and field-effect transistors. In all of these devices, the interfaces between the organic layer and metal surfaces are critical for device performance, since electrons and holes must be transported between the layers. The chemistry and electronic properties of these interfaces may be studied by a variety of surface chemistry techniques, including X-ray and ultraviolet photoelectron spectroscopies (XPS and UPS) and electron loss spectroscopy (ELS). These techniques have been used to investigate how the electronic structure of oligothiophene films change in progressing from thiophene to sexithiophene. It is demonstrated that X-ray and electron irradiation of 3-hexylthiophene condensed on a metal surface results in oligomerization of the monomer and formation of fluorescent films. This method may potentially be used to form novel organic/inorganic composite materials. It is further shown that extensive electron irradiation of poly(3-hexylthiophene) films results in destruction of conjugation and depletion of sulfur in the near-surface region. Experiments are also

discussed that demonstrate that aluminum and potassium deposited on thiophene and oligothiophene films leads to reduction of the thiophene rings. In the case of potassium reacting with sexithiophene, electron donation fills the lowest unoccupied molecular orbitals (LUMOs) and shifts them to below the Fermi level, as demonstrated by UPS studies.

Professor Whitten received his B.S. (1985) in Chemistry and Mathematics from the University of Alabama at Birmingham and his Ph.D. (1991) from Ohio State University. His Ph.D. research involved electron-stimulated desorption from aluminum surfaces, with most of his dissertation research performed at Argonne National Laboratory. His postdoctoral studies (with R. Gomer) at the University of Chicago concerned a variety of topics in surface science, including bimetallic chemistry. He was a Senior Scientist at Nalco Chemical Company from 1995-1998, and has been on the faculty at the University of Massachusetts Lowell since 1998.