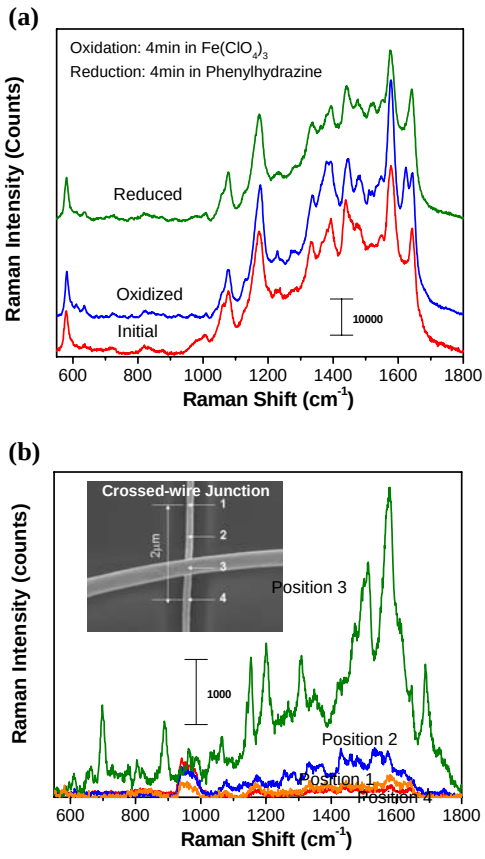
Spectroscopic and Morphologic Characterization of Oligo-aniline Self-Assembled Monolayer for Switching Devices

Masato Maitani[1], Heayoung Yoon[2], Christine McGuiness[3], Lintao Cai[2], Orlando M. Cabarcos[3], Theresa S. Mayer[2], and David L. Allara[1, 3]

[1]Department of Materials Science and Engineering, [2]Electrical Engineering, and [3]Chemistry, Pennsylvania State University, University Park, PA 16802.

We report on the molecular structure of high and low electrical conductance states of oligo-aniline (OA) derivatives, 4-({4-[(4-acetylsulfanyl-phenyl)-methyl-amino]-phenyl}-methyl-mainon)-phynyl), arranged in a self-assembled monolayer (SAM) confined in a metal-molecule-metal junction.[1] It has been proposed that the origin of the observed voltage induced switching is a conformational change of the molecules between two different redox states. In this presentation, we use a combination of spectroscopy and scanning probe techniques to understand the molecular level phenomenon in the molecular junction electronic switches. Infrared reflection spectroscopy (IRS) and X-ray photoelectron spectroscopy (XPS) of the OA SAM on planar substrates samples reveal the characteristics of chemical redox reactions of the SAM. In addition, atomic force microscopy (AFM) shows the surface morphology of OA SAM in an initial and chemically oxidized state. In-situ surface enhanced Raman spectroscopy (SERS) is applied to directly probe chemical and conformational characteristics of SAM embedded in active crossed-wire junctions for molecular electronic switches. Our results support conformational and redox state changes as the origin of electronic switching mechanism. In a separate presentation, Yoon *et al* will discuss parallel evidence of the switching mechanism given by *in-junction* inelastice electron tunneling spectroscopy (IETS).



SERS spectra of OA SAM (a) with different redox state on SERS active porous-Au substrate and (b) in crossed-wire junction with variation of position.

1) L. Cai *et al*, *Nano Lett.*, **2005**, 5 (12), 2365.