Disruption of Molecular Ordering of Organic Films during OFET Electrode Fabrication

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In fabricating a top-contact OFET, Au metal is deposited on top of the organic film to form electrodes. It is known that Au atoms can diffuse into the bulk of organic films. However, the detailed interaction between Au and organic is far from being clear. We have investigated the interfacial reaction between Au and semiconducting triethylsilyethynyl anthradithiophene (TESADT) films using synchrotron based high-resolution photoemission spectroscopy and near-edge X-ray absorption fine structure (NEXAFS) spectroscopy. Figure 1 shows the change of XPS survey spectra with the amount of Au deposited on the TESADT. The C 1s, S 2p and Si 2p intensities of TESADT only decrease gradually before 24Å Au is deposited, but beyond that, the intensities drop rapidly. This behavior suggests that Au atoms diffuse initially into TESADT films instead of forming overlayer. A careful high resolution XPS curve-fitting of C 1s, S 2p, and Si 2p core levels of TESADT and Au 4f level of Au atoms reveals no change in peak shape except a small shift in energy positions of the peaks. This observation strongly indicates that no interfacial reaction takes place. All three core levels of TESADT shift identically to higher binding energy as more Au atoms are deposited. After a deposition of 24 Å thick Au film, the shift settles to 0.3 eV, which is attributed to band-bending derived from metal-semiconducting interface. Carbon *K*-edge NEXAFS results reveal that, with increasing Au deposition, the orientation of aromatic rings of TESADT molecules changes from a uniform tilt of 70° from the surface normal to a completely random fashion, as shown in Fig. 2. Taken together, we conclude that the Au atoms will damage the TESADT thin film during the fabrication of electrodes for top-contact OFET.

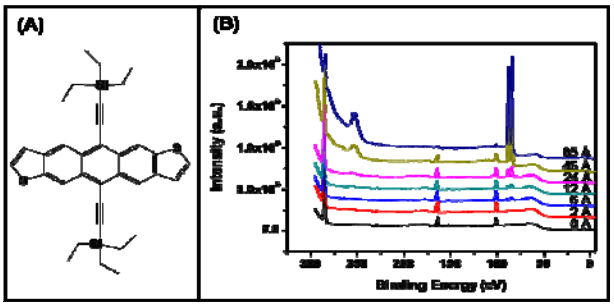

Fig. 1: (A) Chemical formulae of TESADT (B) XPS survey scan spectra of TESADT thin film as Au films of indicated thickness are successively deposited onto it.

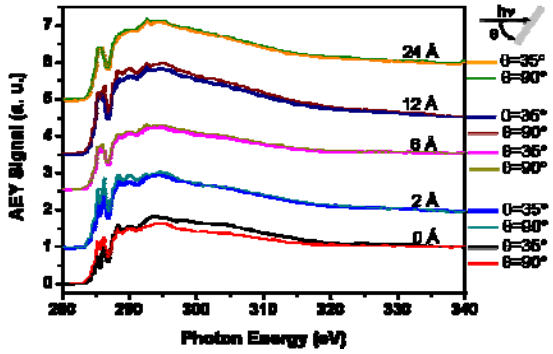

Fig. 2: Change of Polarization-dependent C *K*-edge NEXAFS spectra of TESADT thin film as Au films of indicated thickness are successively deposited onto it.