Molecular and electronic structure at C$_{60}$:pentacene interfaces
S.W. ROBNEY, D.B. DOUGHERTY, NIST-Gaithersburg, W. JIN, W.G. CULLEN, G.J. DUTTON, J.E. REUTT-ROBNEY, University of Maryland — Successful utilization of organic donor-acceptor systems for photovoltaic applications requires understanding factors controlling molecular and electronic structure at interfaces. We have used STM, STS, and photoemission to study the donor-acceptor system C$_{60}$:pentacene. At low coverage, C$_{60}$ deposited on a well-ordered pentacene bilayer structure on Ag (111) adsorbs in between two adjacent pentacene rows. Isolated C$_{60}$ molecules are easily observed at room temperature indicating that the mobility of C$_{60}$ on pentacene is significantly smaller than on metal surfaces. Some images of C$_{60}$ reveal structure that may indicate a preferred C$_{60}$ orientation. Electrostatic contributions to intermolecular interactions are discussed to help explain C$_{60}$ adsorption between pentacene molecules. With increasing coverage, C$_{60}$ forms linear chains, still locked to underlying pentacene rows. A further increase in coverage results in domains of disordered C$_{60}$ that we propose result from competing C$_{60}$-C$_{60}$ and C$_{60}$-pentacene interactions. Information on nanoscale transport gaps and band alignment was obtained using constant-current distance-voltage spectroscopy. A gap of 4.5 eV is found over the linear C$_{60}$ chains compared with a gap of 3.6 eV for the surrounding pentacene bilayer.