Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms
Volume 199 , January 2003, Pages 475-480

doi:10.1016/S0168-583X(02)01595-1 Cite or Link Using DOI


# Synchrotron radiation studies of inorganic–organic semiconductor interfaces

**D. A. Evans, [a], H. J. Steiner[a], A. R. Vearey-Roberts[a], A. Bushell[a], G. Cabailh[b], S. O'Brien[b], J. W. Wells[b], I. T. McGovern[b], V. R. Dhanak[c, d], T. U. Kampen[e], D. R. T. Zahn[e] and D. Batchelor[f]**

[a] Department of Physics, University of Wales, Aberystwyth SY23 3BZ, UK
[b] Physics Department, Trinity College, Dublin 2, Ireland
[c] Surface Science Research Centre, University of Liverpool, L693BX, UK
[d] CLRC Daresbury Laboratory, Warrington WA4 4AD, UK
[e] Institut für Physik, Technische Universität Chemnitz, D-09107, Chemnitz, Germany
[f] BESSY GmbH, Albert-Einstein-Straße 15, D-12489, Berlin, Germany

Available online 16 October 2002.

## Abstract

Organic semiconductors (polymers and small molecules) are widely used in electronic and optoelectronic technologies. Many devices are based on multilayer structures where interfaces play a central role in device performance and where inorganic semiconductor models are inadequate. Synchrotron radiation techniques such as photoelectron spectroscopy (PES), near-edge X-ray absorption fine structure (NEXAFS) and X-ray standing wave spectroscopy (XSW) provide a powerful means of probing the structural, electronic and chemical properties of these interfaces. The surface-specificity of these techniques allows key properties to be monitored as the heterostructure is fabricated. This methodology has been directed at the growth of hybrid organic–inorganic semiconductor interfaces involving copper phthalocyanine as the model organic material and InSb and GaAs as the model inorganic semiconductor substrates. Core level PES has revealed that these interfaces are abrupt and chemically inert due to the weak bonding between the molecules and the inorganic semiconductor. NEXAFS studies have shown that there is a preferred orientation of the molecules within the organic semiconductor layers. The valence band offsets for the heterojunctions have been directly measured using valence level PES and were found to be very different for copper phthalocyanine on InSb and GaAs (0.7 and −0.3 eV respectively) although an interface dipole is present in both cases.

Corresponding author. Tel.: +44-1970-622803; fax: +44-1970-622826