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## Core Level Photoemission Study Of The Interaction Of Pentacene With The Si(100) Surface

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Beamline: U4A

**Introduction:** The chemical bonding interactions of molecular pentacene with the Si(100) surface were investigated by high-resolution core level photoemission spectroscopy. Thin films of pentacene were deposited from a thermal evaporator onto the atomically clean Si(100) surface.

**Results:** Analysis of the Si 2p core level spectra, shown in Figure 1, reveal evidence of a strong chemical interaction between the molecule and the surface. Three chemically shifted components at kinetic energies  $-0.27\text{eV}$ ,  $-0.65\text{eV}$  and  $-1.1\text{eV}$  with respect the bulk peak are required to consistently fit the Si 2p core level.

The intensity of the  $-0.27\text{eV}$  chemically shifted component resulting from the bonding interaction suggests that Si-C bond formation equates to a monolayer coverage. The other components are attributed to adsorption at surface defects and step edges. Annealing the pentacene covered surface in the  $200^\circ\text{C} - 300^\circ\text{C}$  range results in the desorption of molecular layers which had been deposited on top of this chemically reacted layer, leaving the carbon monolayer intact. Figure 2 shows valence band spectra of a thick layer of pentacene and the modifications in this spectrum following an anneal. It is not possible to deduce from valence band studies whether the pentacene involved in strong chemical bonding interactions with the silicon has retained its molecular structure or undergone distortion or fragmentation. This is because the valence band spectrum of the monolayer-terminated surface shown in Figure 2 is significantly different from the thick pentacene layer spectrum. Valence band spectra acquired with both *s* and *p* polarized light on the thicker layers reveal that the pentacene absorbs molecularly on top of the reacted layer with the plane of the molecule lying parallel to the Si (100) surface.

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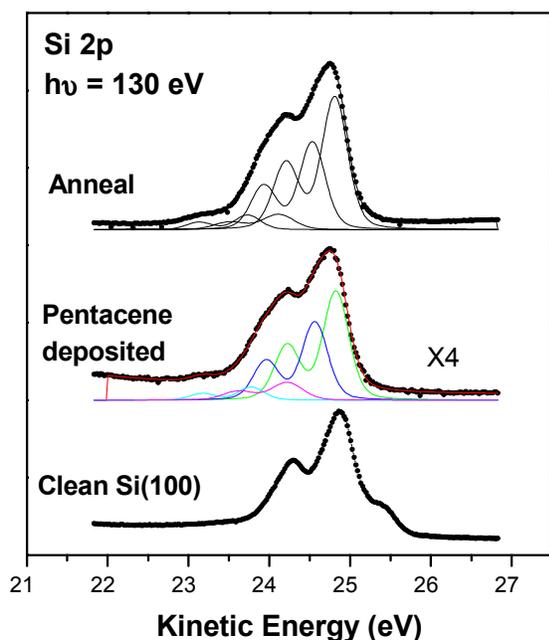


Figure 1

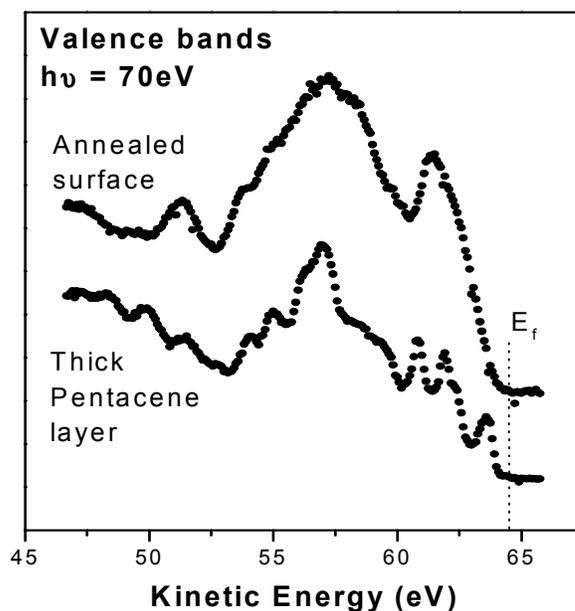


Figure 2