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Core Level Photoemission and X-ray Standing Wave Investigation of S/Ni(117)

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Beamline(s): X24A

Surface science studies in the past have consisted primarily of investigations of flat, nearly perfect (i.e. defect-free) surfaces. However, in the "real world" surfaces are almost never nearly perfect, and many important surface processes are initiated or influenced by the presence of steps and defects. With regards to forming a detailed understanding of the role of adsorbates at steps and defects, which is the subject of this investigation, the adsorbate's structure and geometry (e.g. bond site, bond distance, bond length and orientation) are important pieces of information. Geometric issues have been addressed in previous investigations; however, in only a few cases have direct and quantitative measurements of the geometry of adsorbates on imperfect surfaces been carried out.

The Ni(117) surface consists of (100) terraces which are several atoms wide and broken up by single atom steps. In this investigation, we have prepared clean Ni(117) surfaces by standard techniques of sputtering and annealing. Sulfur adsorption was accomplished by adsorption of hydrogen sulfide at room temperature followed by an anneal to ~400K to desorb excess hydrogen. The surfaces were then examined by core level photoemission spectroscopy and x-ray standing waves. All this work was carried out on beamline X-24A.

We have recorded core level photoemission spectra of the S1s region for S/Ni(117) as a function of hydrogen sulfide dose as presented in Figure 1. Besides the expected increase in S1s peak intensity, we have also observed a shift in the S 1s core level from higher to lower binding energy by ~0.8 eV as a function of increasing hydrogen sulfide dose/sulfur coverage. We attribute this binding energy shift to the adsorption of sulfur at Ni(117) step sites at low coverage followed by adsorption in terrace sites at higher exposures. We are currently in the process of analyzing XSW data at low vs. high coverage to determine if a site change and/or bond distance change can be detected which is consistent with the above model.

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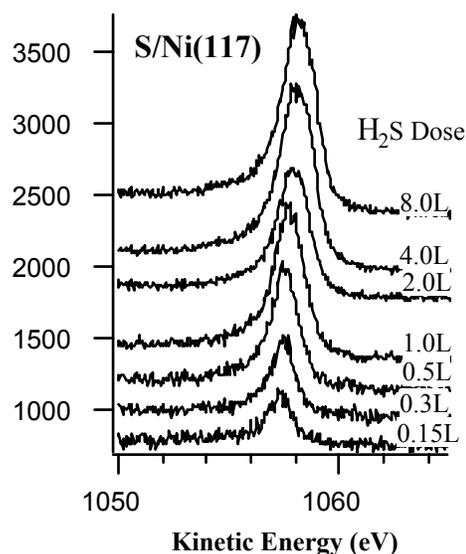


Figure 1: S1s core level region of S/Ni(117) as a function of hydrogen sulfide dose. Photon energy is 3528.6 eV.