SURFACE RESONANT RAMAN SCATTERING FROM THE BARE AND THE (2x1)-O-RECONSTRUCTED Cu(110) SURFACE

N. Esser [a], E. Speiser [a], M. Denk [b], S. Chandola [a], and P. Zeppenfeld [b],

[a]Leibniz-Institut für Analytische Wissenschaften, ISAS e.V., Department for Interface Analytics, Berlin, Germany
[b] Institute of Experimental Physics, Atomic Physics and Surface Science Johannes Kepler University Linz, Austria

In recent years Raman spectroscopy has been successfully employed to study surface vibrational modes of semiconductors via surface resonant Raman scattering. Metals like Cu, Ag, Au, on the other hand, which are important substrates for Surface Enhanced Raman scattering from rough surfaces, are not expected to show Raman signals, due to their crystal structure. As it is known from inelastic electron and He atom scattering the highly anisotropic Cu(110) surface exhibits a characteristic set of vibrational modes. Therefore, it is of particular interest that our surface Raman experiments show that the symmetry breaking on the metal surface enables indeed inelastic light scattering from surface phonon modes. This makes possible new high spectral resolution measurements of the same set of surface vibrational modes and a determination of their intrinsic lifetimes. Comparison of polarization resolved measurements with calculations of the surface vibrational modes provides indications to the enhancement mechanism responsible for the pronounced Raman scattering cross sections and the differences to particle scattering. Oxygen adsorption and the (2x1)O reconstruction of the Cu(110) surface gives rise to a distinct set of surface vibrational modes observable in Raman experiments. The coupling between the Cu(110) surface and the Cu-O chains in the topmost layer can be further clarified by comparison to detailed calculations.

Keywords: Surface Raman Spectroscopy, surface phonons, surface structure