

O 76: Overview Talk (Michael Horn-von Hoegen)

Time: Thursday 9:30–10:15

Location: HE 101

Invited Talk

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1D Metal Wires at Surfaces: Preparation, Phase Transitions, and Ultrafast non-Equilibrium Dynamics — ●MICHAEL HORN-VON HOEGEN — Fakultät Physik und Center for Nanointegration CENIDE, Universität Duisburg-Essen, Lotharstr. 1, 47057 Duisburg

The Indium induced (4×1) reconstruction on Si(111) is a famous prototype for 1D metal wires at surfaces. Indium atoms form parallel zigzag chains with anisotropic metallic conductivity. At 130 K a metal-insulator transition to the (8×2) ground state takes place. A Peierls-like distortion causes periodicity doubling and opening of a bandgap. A robust hysteresis of 8.6 K width during temperature cycling proves that this phase transition is first-order. The non-equilibrium structural

dynamics of the (8×2) is studied by ultra-fast electron diffraction. We use a pulsed electron gun in a RHEED geometry with a fs laser system in a pump probe setup. A tilted pulse front scheme improves the temporal resolution to 350 fs. Upon photo excitation the (8×2) ground state is driven in less than 400 fs to the (4×1) excited state as observed through the transient RHEED spot intensity. Heating of the In atoms from 30 to 60 K occurs delayed on a time scale of 3 ps. Thus the phase transition is driven electronically and not thermally. The surface then remains for nanoseconds in a super cooled metastable (4×1) state, which is not accessible under equilibrium conditions. The relaxation into the (8×2) groundstate happens through the nucleation of the (8×2) at pre-existing adsorbates which trigger a 1-dim. recrystallization front propagating with 100 m/s as determined from a transient spot profile analysis of the (8×2) spots.