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TUHH Ceramics

INSTITUT FÜR KERAMISCHE HOCHLEISTUNGSWERKSTOFFE

MATERIALWISSENSCHAFTLICHES KOLLOQUIUM

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Phases and Phase Transitions of Ultrathin Cobalt-Oxide Films

Prof. Dr. Klaus Heinz
Lehrstuhl für Festkörperphysik, Universität Erlangen-Nürnberg

Cobalt oxide is an important material for magneto-electronic devices. With the latter's ever decreasing size the structural modifications due to nanoscaling become important, in particular as there is an intimate correlation between structure and magnetism.

In this light the structure of ultrathin cobalt-oxide films has been investigated whereby low-energy electron diffraction (LEED) together with scanning tunnelling microscopy (STM) was applied. Films of different thickness were grown on an Ir(100) surface. For oxygen-rich preparation conditions spinel-type Co_3O_4 is observed which transforms to rocksalt-type CoO by loss of oxygen during thermal annealing. Surprisingly in view of the quadratic substrate the films are in the polar (111) orientation. Also as a surprise comes the structure of CoO films whose rocksalt-type layer stacking switches at the surface, so that the latter forms a slab with wurtzite structure. With further decreasing oxygen content further and also unusual film structures develop. Even more, when a reconstructed phase of Ir(100) is used as substrate laterally nanostructured oxides can be produced.

In the talk the power of modern quantitative LEED in combination with STM is demonstrated. It is shown how the films' crystallography accounts for the avoidance of the polarity problem and how close it comes to predictions from first principles calculations.

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