OXIDE MATERIALS AT THE TWO-DIMENSIONAL LIMIT

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Frontiers in Catalysis Science and Engineering
Seminar Series

Presented by…

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Abstract

Thin films of oxides have widespread applications in science and technology. With the increasing trend towards miniaturisation and with the emerging nanotechnologies, the oxide phases of interest become thinner and thinner, reaching thickness levels below one nanometer and eventually the two-dimensional (2-D) limit of single-atom or single-polyhedron thick layers. The reduction in dimensionality from 3-D bulk to 2-D surface materials is accompanied by a drastic change in physical and chemical properties. In this lecture, I will investigate this transition from 3-D to 2-D and examine what happens when oxide layers become thinner and thinner. With the help of paradigmatic examples, I will present the novel structure concepts of 2-D oxides and their associated electronic and magnetic behaviour. The arena for the discussion will be set up by nanolayers of 3d transition metal oxides, from manganese oxide to nickel oxide, supported on noble metal single crystal surfaces. Although a plethora of different structures with different oxidation states and stoichiometries, depending on the thermodynamic growth parameters during fabrication, have been observed for different oxide-metal support combinations, common structure concepts with similar atomic metal-oxygen building blocks can be identified. The role of epitaxial strain, polarity and charge transfer across the interface for the stability of 2-D oxides will be examined. Kinetic phenomena during growth are important in determining the surface morphology, in stabilising transient structures, and for inducing nanopatterned surfaces; examples will be presented to highlight such kinetic effects.

Finally, following the road of increasing complexity, I will progress from binary oxide materials to ternary oxides and present a radically new preparation route for 2-D metal tungstate phases, MWO_4.

Hosted by: Zdenek Dohnalek

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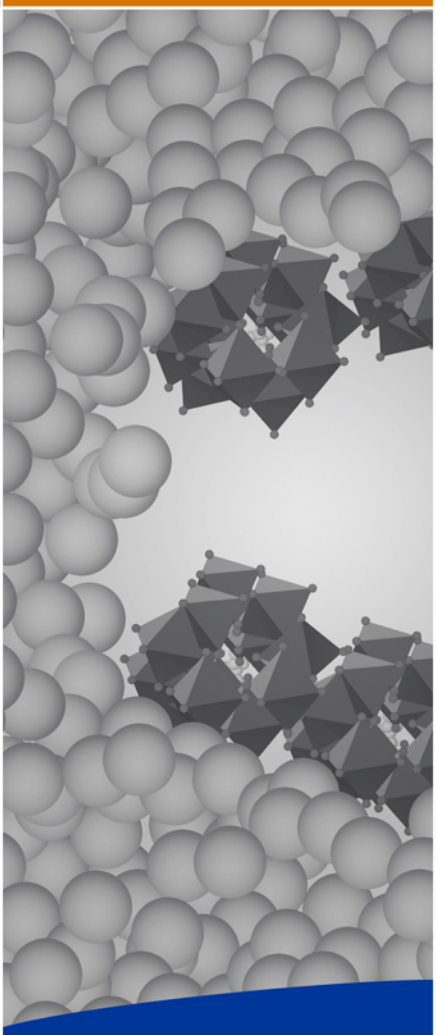

Oct. 7, 2014

EMSL Auditorium

10:00 am