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Poster

Epitaxial Iron Oxide Growth on Vicinal Pt(111): Well-defined defective model systems?

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Abstract:

Heterogeneous catalysts consist often of metals in contact with oxides and the activity depends on the interaction between them. In addition, the defect structure of the surface is of high importance for the catalytic activity. The common electron-based surface science techniques allow the characterization of model catalyst surfaces with atomic precision. Studied model catalyst systems include single crystal surfaces, epitaxial compound films, or well-defined particles deposited on single-crystalline supports. However, real catalysts contains a defect structure which is difficult to model in a well-defined manner.

In order to study the controlled introduction of defects into iron oxide model catalysts for the dehydrogenation of ethylbenzene to styrene, we have grown different iron oxide phases on a stepped Pt(9 11 11) single crystal surface. The hope was that this may provide a way to introduce well-defined step defects into the epitaxially grown films.

For coverages below 1 ML, FeO(111) films wet the vicinal Pt substrate. The step structure changes under formation of doubled and triplicated terrace widths and step heights. Further cycles of iron deposition and oxidation lead to a Stranski-Krastanov-type growth of Fe₃O₄(111) islands which initially are elongated along the edge direction. However, the morphology of a coalesced closed film is almost unaffected by the underlying substrate step morphology. High pressure oxidation of Fe₃O₄ films results in poorly defined Fe₂O₃(0001).

Although FeO films grown on the vicinal Pt surface may serve as model systems for systematic studies of well-defined defective oxide surfaces, the catalytically more relevant Fe₃O₄ and Fe₂O₃ phases could not be obtained reproducibly with a well-defined defect structure.