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Oral contribution

Self-assembled Fe_3O_4(111) nanostructures in ultrathin FeO(111) films on Ru(0001)

G. Ketteler, W. Ranke*

Department of Inorganic Chemistry, Fritz-Haber-Institute of the MPG, Faradayweg 4-6, 14195 Berlin, Germany

* Corresponding author: e-mail ranke@fhi-berlin.mpg.de, phone +49 30 8413 4523, fax +49 30 8413 4401

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Abstract

Ultrathin films of FeO(111) can be grown on Ru(0001) by repeated cycles of evaporation of Fe and subsequent oxidation at temperatures around 870K. At equilibrium conditions, 1-2 ML FeO(111) wet the substrate before further growth proceeds by the formation of Fe_3O_4(111) islands (Stranski-Krastanov growth mode). However, if larger amounts of Fe are deposited in one turn on the substrate and oxidized afterwards, metastable FeO(111) films with a thickness up to 4 ML can be obtained. They have strongly expanded lattice constants and form specific coincidence structures with the Ru(0001) substrate. In films with a thickness of ~4ML, self-assembled, periodically arranged Fe_3O_4(111) nanodomains with diameters of ~2-3nm form in the FeO(111) film. Further oxidation causes these domains to grow and finally coalesce into a closed Fe_3O_4(111) film. Self-organization and phase transition are discussed using thermodynamic and electrostatic arguments.