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The nucleation and growth of ordered Fe and FeO nanoparticles on reconstructed Au(111) surfaces NEETHA KHAN, CHRISTOPHER MATRANGA, U.S. Dept. of Energy — Iron-based catalysts, including iron oxides, are an important class of materials with relevance to Fischer-Tropsch catalysis and gas-sensing applications. By growing nanostructured particles on single-crystal surfaces, we can create a model system to study size and shape effects on reactivity. We have studied the formation of monolayer thick iron oxide nanoparticles and thin films on the reconstructed Au(111) surface. STM, XPS, ISS, and LEED were used to evaluate the structure and composition of the iron oxide nanoparticles and films as a function of growth conditions. Iron oxide was grown by depositing iron on Au(111), followed by oxidation at room temperature and annealing to 700 K. XPS results indicate that the Fe is oxidized at room temperature, but the STM results indicate that the particles are not ordered until after annealing to 700 K. Atomically-resolved STM images show that at 0.3 ML Fe coverage, iron oxide nanoparticles, pseudo-hexagonal in shape are formed, with large defects occurring in the corners. STM images of FeO particles over 0.5 ML Fe also show evidence of a non-coincidence overlayer lattice with a short periodicity of 0.25-0.3 nm modulated by a larger periodicity of approximately 3.5 nm. The larger periodicity results from a moiré pattern formed between the iron oxide overlayer and the underlying Au(111) surface.

Christopher Matranga
U.S. Dept. of Energy

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