Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Tuning Rhenium Surface Morphology by Kinetic Control of Adsorbates HAO WANG, Department of Physics and Astronomy, Rutgers Unversity, Piscataway NJ 08854, XIAOFANG YANG, Department of Chemical and Biological Engineering, Princeton University, Princeton, NJ 08544, GRANT JUNNO, WENHUA CHEN, Department of Physics and Astronomy, Rutgers Unversity, Piscataway NJ 08854, BRUCE KOEL, Department of Chemical and Biological Engineering, Princeton University, Princeton, NJ 08544, ROBERT BARTYNSKI, Department of Physics and Astronomy, Rutgers Unversity, Piscataway NJ 08854, PAYAM KAGHAZCHI, TIMO JACOB, Institute of Electrochemistry, Ulm University, Albert-Einstein-Allee 47, D-89069 Ulm, Germany — The surface morphology of Re($11\bar{2}1$) can be tailored on the nanometer scale by careful control of adsorbate species, adsorbate coverage, and surface temperature. We have found that drastically different morphologies of three-sided pyramids versus two-sided ridges can be induced by adsorption of either carbon or nitrogen, respectively. These structures expose well-defined nanoscale facet planes with controlled size and can serve as model catalysts and catalyst supports. The nitrogen-induced ridges are formed by ($13\bar{4}2$) and ($31\bar{4}2$)facets while the carbon-induced pyramids by ($11\bar{2}0$),($01\bar{1}1$) and ($10\bar{1}1$) facets. We also observed a (2×1) reconstruction of Re($11\bar{2}1$) at low nitrogen coverage which acts as a precursor state for nitrogen-induced faceting. DFT calculations provide an atomistic understanding of facet formation in terms of the geometries and energetics of adsorbates on the substrate and facets as well as corresponding surface phase diagrams.

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Date submitted: 15 Nov 2013 Electronic form version 1.4