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Morphology evolution in oxygen-induced faceting of Re (12-31)
HAO WANG, WENHUA CHEN, ALLY S.Y. CHAN, THEODORE E. MADEY, Dept. of Physics and Lab for Surface Modification, Rutgers University, Piscataway, NJ 08854 — The adsorption of oxygen on Re (12$\bar{3}$1) has been studied by low energy electron diffraction (LEED), Auger electron spectroscopy (AES) and scanning tunneling microscopy (STM). The atomically rough Re (12$\bar{3}$1) surface remains planar at room temperature after being exposed to oxygen. However, the O/Re (12$\bar{3}$1) surface can undergo drastic morphological changes to become completely faceted upon annealing at 700K or higher temperatures. With low oxygen coverages ($\sim$0.5ML), the facets form ridge-like structures and grow along the ridge direction [$\bar{2}$113]. The size of the ridges grows with annealing temperatures. The typical dimensions for the ridges are $\sim$8nm wide and $>$50nm long upon annealing at 1000K. The orientations of the two facets of the ridge are identified as (11$\bar{2}$1) and (01$\bar{1}$0) by LEED measurements, which are consistent with kinematical simulations of the LEED patterns and confirmed by STM measurements. When the oxygen coverage is about 1ML, the ridge-like structure is found to be truncated by a third set of facets in the annealing temperature range between 900K and 1300K. The faceted O/Re surfaces may not only provide us templates to grow ordered nano-structures but also are possible candidates to study structural sensitivity in catalytic reactions.

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