Morphology evolution in oxygen-induced faceting of Re (12-31)

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NJ 08854 — The adsorption of oxygen on Re (1231) has been studied by low energy
electron diffraction (LEED), Auger electron spectroscopy (AES) and scanning tun-
neling microscopy (STM). The atomically rough Re (1231) surface remains planar
at room temperature after being exposed to oxygen. However, the O/Re (1231) sur-
face can undergo drastic morphological changes to become completely faceted upon
annealing at 700K or higher temperatures. With low oxygen coverages (∼0.5ML),
the facets form ridge-like structures and grow along the ridge direction [2113]. The
size of the ridges grows with annealing temperatures. The typical dimensions for the
ridges are ∼8nm wide and >50nm long upon annealing at 1000K. The orientations
of the two facets of the ridge are identified as (1121) and (0110) by LEED measure-
ments, 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 anneal-
ing 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.