Faceted/defaceted phase transition of Pd/W(111)

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Using temperature programmed Auger and LEED we have studied the faceted/defaceted phase transition of Pd/W(111) system. Contrary to all previous wishful thinking, we found the thickness of the Pd layer wetting the tungsten surface actually undergoes reversible change during faceted/defaceted phase transitions. The wetting layer is thicker by about one twelfth of a physical monolayer on the \{112\} faceted surface. The phase transformation is also asymmetric. The facet forming process during cooling is "slow" and the surface usually lags behind the cooling process. If cooled very slowly, the transition occurs in a very narrow temperature range. The defaceting process, on the other hand occurs in a wide temperature range even if we heat the surface very slowly, suggesting that the surface remains close to thermodynamic equilibrium but there are many intermediate states at different temperature, defining a gradual path between faceted and defaceted phase. Part of these states may be due to asymmetry between pits and tips of the faceted surface.

Fig.1 Intensity of LEED spot from (111) surface as the Pd covered tungsten surface undergoes faceted/defaceted phase transitions. Traces of different color are from experiments with different heating and cooling rates.