

DS 22: In situ STM

Time: Thursday 9:30–10:00

Location: H34

Invited Talk

DS 22.1 Thu 9:30 H34

Grain Growth and Film Growth observed with Real-time, in-situ STM — ●MARCEL J. ROST — Kamerlingh Onnes Laboratory, Leiden, The Netherlands

The ever-growing variety of applications of film and thin film technology clearly demands fundamental research that links well known atomic processes, such as diffusion and nucleation, with the mesoscopic evolution of film properties, both during film growth and during a post deposition treatment (heating, stress, coating,...). We present the first *real-time, in-situ* movies on polycrystalline gold films that contain observations of film growth and grain growth obtained with a variable-temperature Scanning Tunneling Microscope (STM).

Atomic step resolution all over the film allowed us to identify the in-

dividual grains and, thus, also the grain boundaries. As we heated the film, we directly observed grain boundary diffusion and grain growth and found unexpected changes in surface roughness: an initial decrease of the roughness was followed by a later increase.

In order to further elucidate film growth, we evaporated several tens of monolayers of gold under grazing incidence on top of a well annealed polycrystalline gold film, *while* measuring with the STM. This enabled us to visualize film growth in real time. Analyzing the intermediate and developing film structures we succeeded in classifying the growth mode within the empirical film-growth structure-zone model introduced by Mochvan and Demchishin in 1969. Moreover, the direct observation provides us with atomic-scale insight in this classical growth mode: columnar grain growth is based on step-flow and spiral growth.