Coarsening Dynamics of Au Precipitates in a Thin Fe Film

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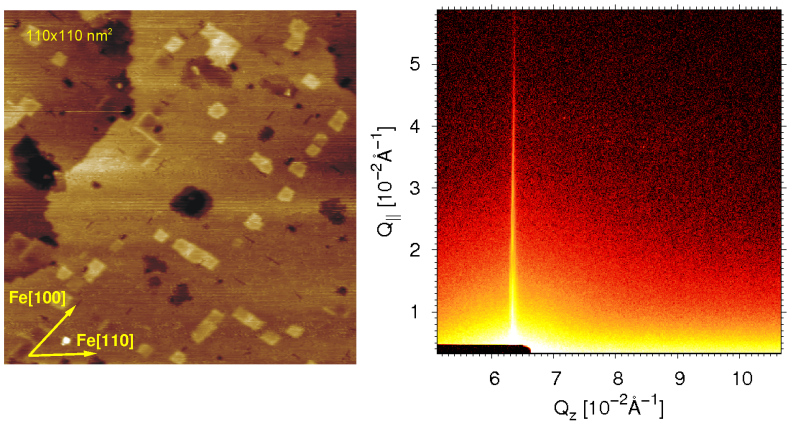
Iron films grown on a Au(100) substrate are one of the best known examples for self-surfacting action promoting a flat 2D-growth [1]. During iron evaporation gold atoms are segregating onto the iron surface. As a result the iron film is immediately covered by a floating Au layer whose surfactant effect induces the layer-by-layer growth mode of the iron film. At elevated temperatures the segregation process is enhanced and Au precipitates are formed within the iron layer. Due to the strongly differing atom sizes between Au and Fe, lattice strains are introduced, causing plate-like precipitates aligned along Fe<100> directions.

The precipitate growth and coarsening can be monitored *in situ* by changes in the grazing-incidence small-angle X-ray scattering (GISAXS) diffraction pattern. Furthermore, by combining GISAXS with the method of X-ray photon correlation spectroscopy (XPCS) it becomes possible to study the slow dynamics of the coarsening process near the surface.



Left: STM topograph of a 10ML Fe film on Au(100) after 1h of annealing at 610°C. [1] **Right:** GISAXS diffraction pattern with pronounced speckles of an identical sample annealed for 4.5h at 650°C.

In order to analyze the fluctuating speckle intensities the detrended fluctuation analysis (DFA) was applied [2,3]. The DFA was performed for different scattering vectors ($Q_{\|}$) with the incident X-ray beam parallel to the Fe[100] and Fe[110] direction, respectively. Experimental results indicate stronger coarsening dynamics along Fe[100] directions. This finding suggests that coalescence of neighboring precipitates plays a leading role for the present coarsening mechanism

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