Imaging Diffusion Zones in Photoelectron Emission Microscopy

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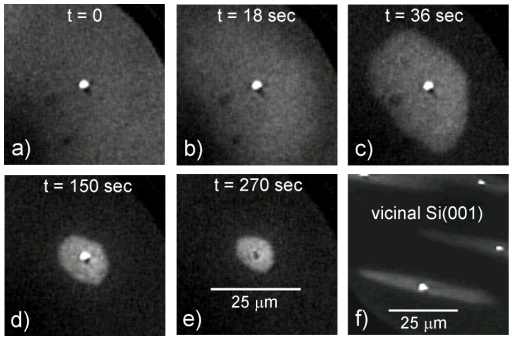
During high temperature annealing of 3D Ag islands grown on Si(001) PEEM images reveal the emergence of a bright zone surrounding the decaying islands. The effect is shown in the figure below. Images a) through e) illustrate the time evolution of the bright zone around a Ag island on flat Si(001), and f) shows the bright zone at a particular time on vicinal Si(001). Microdiffraction patterns from these bright areas display a (2x3) Ag reconstruction. The decaying Ag islands act as sources of Ag adatoms which then diffuse on the surface, creating the reconstruction where the coverage is sufficiently high. The (2x3) reconstruction spreads away from the island to a distance determined by the interplay of diffusion and desorption, and the outer boundary of the reconstructed zones constitutes an "iso-coverage boundary." The shape of these reconstructed zones is commensurate with the degree of diffusion isotropy in the system, and we demonstrate that the imaging of the reconstructed zones, which we classify as "isozones," constitutes a unique experimental method for directly imaging diffusion fields in epitaxial systems. We describe the dynamics of the thermal decay of the islands and the surrounding isozones in the context of a simple continuum model that takes into account the collective effects of the interplay between the rates of diffusion and desorption.



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