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Size-Ladder in Ripening by Cluster Diffusion Starting from Single Atoms

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We present a novel approach to create metal islands on close-packed single crystal metal surfaces with well defined sizes in the range of a few atoms. For elements with large cohesive energies, we observe that small clusters such as dimers and trimers diffuse as a whole at much lower temperatures than needed for their dissociation. Since the diffusion barriers increase with increasing island size we observe a stepwise increase of the mean island size from 1 to 2.5, to 4.5, to 7.0. The fact to able to produce large number densities of islands with these sizes enables to investigate the evolution of the chemical and physical properties with size in an atom-by-atom way. We demonstrate for the case of Co/Pt(111) how the experimental transition temperatures between the respective size plateaus can be used to infer monomer, dimer, and trimer migration barriers.