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Ultrahigh Vacuum Scanning Tunneling Microscopy Study of Template-Stripped Metal Surfaces

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A novel method is presented for preparing ultraflat noble metal surfaces in situ under ultrahigh vacuum (UHV) from thin metal films that are deposited via physical vapor deposition on commercially available silicon (Si) substrates. The method is based on template stripping of thin metal films from Si wafer surfaces under UHV condition and is utilized to prepare atomically smooth, uncontaminated silver (Ag), gold (Au), copper (Cu) surfaces of group 11 transition metals. These template-stripped metal surfaces were characterized by scanning tunneling microscopy (STM) under UHV condition. The resulting STM data demonstrate that under the surface preparation conditions examined this study, the flatness and quality of template-stripped metal surfaces are dependent on post-metal deposition annealing temperature and thickness of deposited metal films. In large area STM images for observation of entire morphology of template-stripped metal surfaces, grain domain size evolution is observed and terraces of the grain domains have a better flatness under specific temperature and thickness condition. From high resolution STM images at room temperature, atomic surface structures of these template-stripped metal surfaces are successfully confirmed in local terrace of grain domain. Atomic roughness of template-stripped metal surfaces are equivalent to or better than those of single crystal metal surfaces.