# Electronic structure of PdAg(100) ordered surface alloys using Synchrotron Radiation

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Metal deposition on a dissimilar metal surface is of great interest both from fundamental and technological points of view. The metal deposition on a crystalline metal substrate can lead to cluster growth or layer by layer growth depending on the lattice match between the substrate and adsorbate. Synthesis and characterization of bimetallic alloys are of importance for a number of technological applications like catalysis, sensors and electronics. Pd was long back predicted to be ferromagnetic at an expanded lattice and recent experiments found the ferromagnetic behavior in Pd fine particles. Surface alloy formation and inter diffusion of Pd was observed when Pd was deposited on Ag (100) kept at elevated temperatures.

PdAg(100) ordered surface alloys have been prepared *in-situ* in $1.0\times10^{-9}$ Torr pressure in the preparation chamber of THE-XPS machine at BW2 beamline by e-beam evaporation of Pd onto clean Ag(100) surface. Various compositions of surface alloys were prepared by evaporating 0.5, 1.5, 2.0, 2.5 and 3.0 ML equivalents of Pd. These alloys have been investigated using high energy photoemission spectroscopy (HEPES) and normal incidence X-ray standing wave (NIXSW) techniques. Ag(200) reflection at 3034.8 eV was used for NIXSW measurements and HEPES measurements were done using the same photon energy. Total resolution in photoemission measurements was 0.45 ev measured as the FWHM of Ag $3d_{5/2}$ spectra.

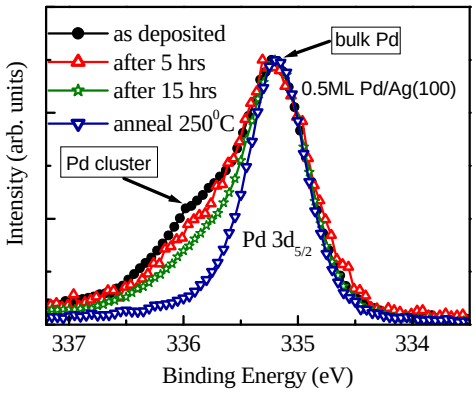


FIG. 1: Pd $3d_{5/2}$ spectra for 0.5ML Pd on Ag(100) surface. Sample was studied keeping it inside the vacuum chamber for several hours and also by annealing at 250°

Figure shows the Pd $3d_{5/2}$ spectra of the 0.5 ML Pd deposited on Ag(100) crystal keeping at room temperature. Pd $3d_{5/2}$ speatra exhibits a main peak at 335.1 eV binding energy (B.E.) and a shoulder at 0.7 eV higher B.E. The intensity of the high B.E. shoulder decreased gradually with time and completely disappeared by an annealing at 250°C which suggests that as deposited Pd on Ag(100) at room temperature forms volatile clusters which slowly get annealed with time even at room temperature and settle into a stable adsorption site. The main peak at 335.1 eV corresponds to the alloy $Pd_5Ag_{95}$. Interestingly, the alloy formation occurred at room temperature in as deposited sample.

Core level shift(CLS) of Ag $3d_{5/2}$ of the ordered surface alloys is in close agreement with the previously reported experimental and calculated CLS of random bulk alloys. On the other hand CLS of Pd $3d_{5/2}$ exhibit a drastic difference both in magnitude and the direction from that of random bulk alloys which suggests that low dimensional effects are prominent in Pd CLS compared to Ag CLS. Ag core levels exhibited a disorder induced broadening whereas the Pd core levels exhibited increasing asymmetry on the high B.E. side of the spectrum with Pd coverage.

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