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The electronic structure of the ion-beam-mixed Pt-Cu alloys by XPS and XANES

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Abstract

In the thin film alloy formation of the transition metals, ion-beam-mixing technique forms a metastable structure, which cannot be found in the arc-melted metal alloys. Specifically, it is well known that the studies about the electronic structure of ion-beam-mixed alloys provide the useful information in understanding the metastable structures in the metal alloy.

We studied the electronic structure change in the ion-beam-mixed Pt-Cu alloys by XPS and XANES. These analysis tools provide us information about the charge transfer in the valence band of intermetallic bonding.

The multi-layered films were deposited on the SiO_2 substrate by the sequential electron beam evaporation at a pressure of less than 5×10^{-7} Torr. These comprise of 4 pairs of Pt and Cu layers, where thicknesses of each layer were varied in order to change the alloy composition. Ion-beam-mixing process was carried out with 80 keV Ar^+ ions with a dose of 1.5×10^{16} Ar^+/cm^2 at room temperature.

The core and valence level energy shift in these system were investigated by x-ray photoelectron spectroscopy(XPS). Photoelectrons were excited by monochromatized Al K α(1486.6 eV). The pass energy of the hemispherical analyzer was 23.5 eV. Core-level binding energies were calibrated with the Fermi level edge.

Pt L_3-edge and Cu K-edge XANES spectra were measured with the flourescence mode detector at the 3C1 beam line of the PLS (Pohang light source).

By using the change of White line(WL) area of the each metal sites and the core level shift, we can obtain the information about the electrons participating in the intermetallic bonding of the ion-beam-mixed alloys.

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