

CHARACTERIZATION OF NANO-SCALE MULTILAYERS BY HAXPES UNDER X-RAY STANDING WAVE EFFECT

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Abstract

We use hard x-ray photoemission spectroscopy (HAXPES) [1] to characterize a series of Pd/Y nano-scale multilayers designed to work in the 7.5-11 nm wavelength range. The samples, prepared by magnetron sputtering, are deposited either with or without nitrogen introduced in the sputtering gas. The aimed period of the samples is 4 nm. The experiments consist in obtaining the core level spectra of the various elements under hard X-ray exposure. The interferences between the incident photons and reflected photons result in a periodic electric field that influences the photoemission intensity. Such influence depends on the grazing angle of the incident X-ray beam, thus we measure the photoemission spectra as a function of the grazing angle. The angular scan is made in the range given by the Bragg law, the multilayer period and the incident photon energy. Given the period of the multilayer and the presence of a 2.5 nm-thick B₄C capping layer, the photon energy is chosen to be 10 keV in order to probe the first 5-6 periods of the stack. Thus the Bragg angle is a little less than 1°. Rotating the sample enables putting the nodes of the electric field at some particular location of the stack, thus to make the excitation depth-selective, probing one interface or another or the center of one given layer. The changes of the chemical shift in the Pd 2p and 3d, Y 2p and 3d, O 1s, N 1s, C 1s and B 1s as a function of the angle, that is to say as a function of the location in the stack will give information about the possible interfacial process taking place in the Pd/Y multilayers.

[1] D. Céolina et al., J. Electron. Spectrosc. Relat. Phenom. 190, 188–192 (2013)

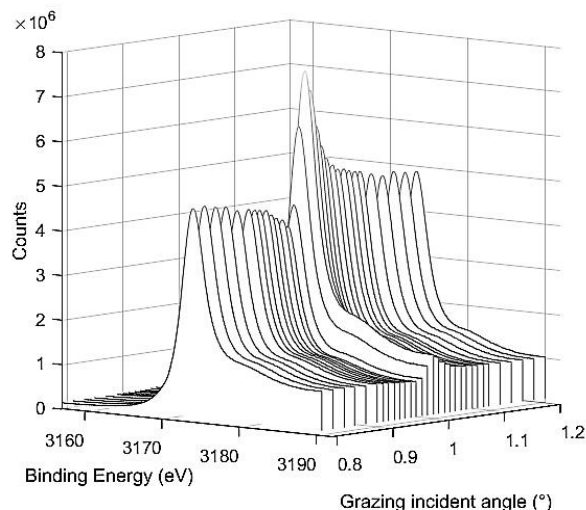


Fig. Intensity variation of Pd La photoemission of a Pd/Y nano-scale multilayer irradiated by 10 keV X-ray beam.