ESRF	**Experiment title:** Interface diffusion profile in CoSi/Si multilayers studied by High Energy X-Ray Photoelectron Spectroscopy	**Experiment number**: 25-02-661
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Report:

The aim of this experiment was to carry out photoemission measurements in Co-Si based multilayers using hard x-rays so that information on the diffusion profile and electronic structure of buried layers and interfaces could be obtained. The experimental setup used was the UHV chamber installed in the BM25B beamline, which is equipped with a cilindrical mirror analyzer (CMA) designed to measure electrons having kinetic energies as high as 15 keV.

By using this setup, we have been able to systematically measure Co 1s, Co 2s, Si 1s, Cu 1s and Cu 2s photoemission peaks of three Co-Si multilayers (two of them grown on top of a 100 nm thick Cu buffer) as a function of the photon energy in the range 9 to 15 keV. Typical nominal thickness of the Co and Si layers has varied between 3 and 10 nm. In addition to the Co-Si multilayers, two more samples consisting of Si layers on top of a 100 nm thick Cu buffer have been also measured in order to obtain information on the photoionization process cross section and on the attenuation lengths. In total, the measurements have accumulated around 180 spectra.

Two types of analysis can be made with these spectra. One could focus on estimating the intensity of the peaks and analyzing its variation as a function of the photon energy, which controls the kinetic energy of the emerging electrons, and consequently, is directly related to the probing depth of the measurement. This could allow the reconstruction of the

compositional depth profile [1]. However, the subtle differences expected in the different alternative compositional profiles and the noise inherent to the experimental measurements, related to the difficulties in making a proper normalization of the data, makes rather difficult to proceed in this way. A second option, which is being currently explored, is based on studying the inelastic part of the spectra, including plasmon energy losses, so that an intrinsic normalization can be made at each energy using the intensity of the corresponding core level peak. Some examples of Co 1s and Co 2s peaks measured at extreme energies are given in figures 1(a) and 1(b), after Shirley background correction. Figures 1(c) and 1(d) show examples of plasmon intensity decays at Co 1s and Cu 1s peaks, for different samples, to illustrate the kind of variations observed in the spectra. The corresponding analysis is currently under way.

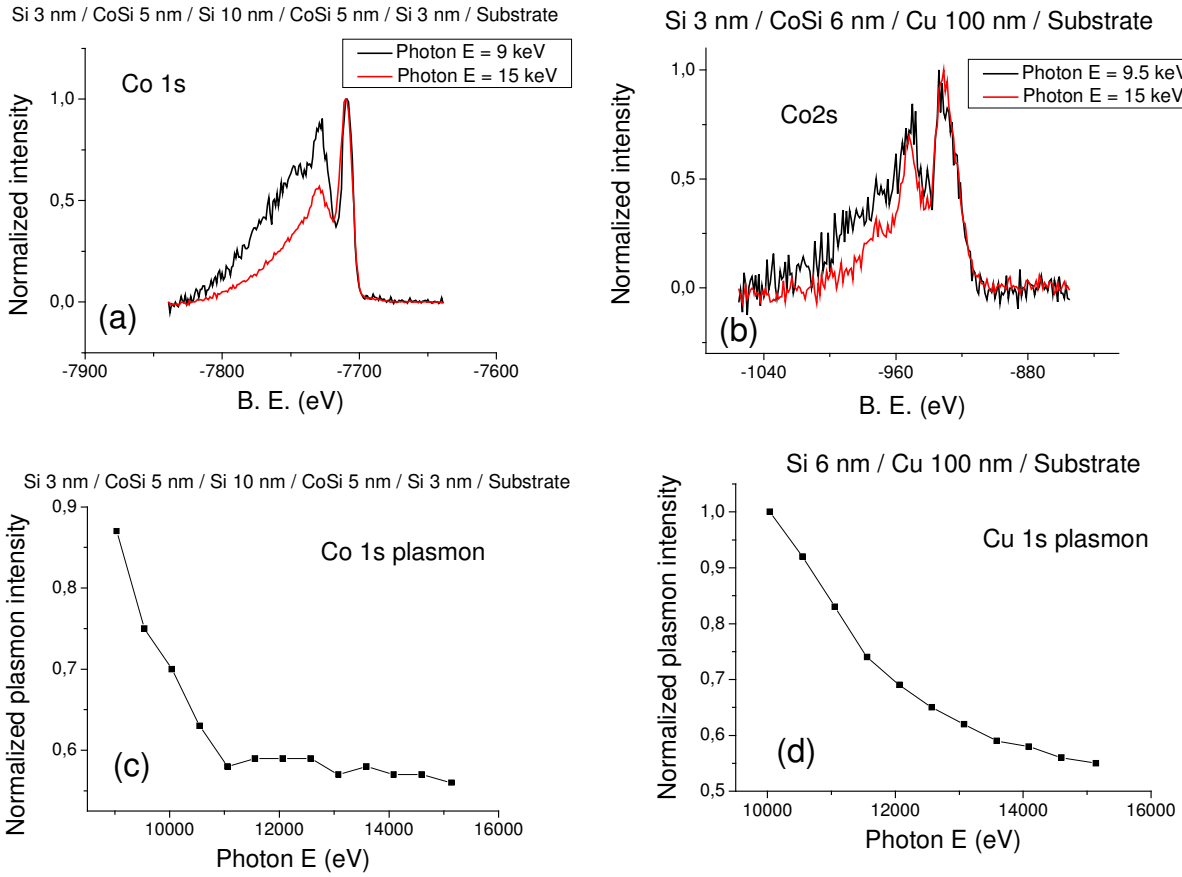

Figure 1. (a) Co 1s peaks measured at 9 and 15 KeV photon energy. (b) Co 2s peaks measured at 9.5 and 15 keV photon energy. (c) and (d) Co 1s and Cu 1s plasmon intensity variation normalized to core level peak intensity as a function of photon energy.

References.

[1] J. Rubio-Zuazo and G. R. Castro, Journal of Physics: Conference Series 100 (2008) 012042