

Experiment MA-3432, BM08

Title: Influence of the film/substrate interface in local structure of Au-Co metallic glasses for magnetoplasmonics

Participants: Chiara Maurizio, Valentina Mattarello, Anna Marafon

Experimental conditions: XAS at Au-L3-edge and Co K-edge at 80 K.

Samples:

A- Au-Co films, 15 nm thick, prepared by co-sputtering deposition. Heating treatments in inert atmosphere are used to test the stability of the alloy phase. Two reference Au-Co films, 30 nm thick.

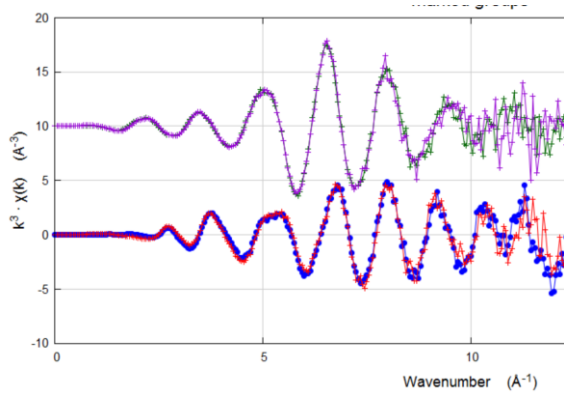
Report

The experiment originated from the experimental observation that the XRD spectrum of a 30 nm-thick Au-Co film was different from a 15 nm-thick one (with the same atomic composition). Indeed, the $w-2\theta$ XRD scans showed the fcc-(111) diffraction peaks corresponding to two different values of the lattice parameter. We measured Au L3-edge and Co K-edge XAS spectra of all the films (atomic composition Au₁Co₁, Au₂Co₁, Au₁Co₂).

The XAS spectra were measured in fluorescence mode by a 12 elements HP Ge detector, at 80 K to limit atomic vibrations. The incidence geometry was so that the polarization vector was almost parallel (10 deg off) and also perpendicular (10 deg off) to the sample surface. Data quality was pretty nice in all cases.

The main results are:

- i) For all the samples, the first coordination shell is composed of both Au and Co, when measured at both Au- and Co- edges.
- ii) The Au-Au, Au-Co and Co-Co first coordination distance are different. Nevertheless, they do not strongly vary with the average sample composition.
- iii) The local order around both Co and Au is isotropic. In the first figure, the spectra recorded in the two geometries (polarization vector parallel and perpendicular to the film surface) are compared, for both Co-edge (upper spectra) and Au-edge (lower spectra) for the film of composition Au₁Co₁.
- iv) The measured local order does not depend on the film thickness, despite the crystalline signal (from XRD) does. This indicates that the crystalline phase is a minor fraction of the film.



These results are included in the paper: C. Maurizio et al, Appl. Surf. Sci. 513 (2020) 145779.