	Experiment title: A Grazing Incidence Small Angle X-ray Scattering study of magnetic nanoclusters in silica glass	**Experiment number**: HS-1269
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Report:

Composites formed by metal nanoclusters embedded in glass matrices are interesting as magnetic materials. The magnetic behavior of these nanocomposites depends critically on the cluster structure, size and composition. The preparation of "mixed" colloidal structures, containing clusters of either different metals or formed by metal alloys, has recently drawn new great attention, due to the possibility of further tailoring their magnetic performances. In general, the magnetic properties of these composites depend critically on the clusters nanostructure and composition, in terms of magnetoelastic contribution related to lattice stress, or changes in the material magnetic response when a change in the crystalline phase occurs following the cluster size reduction. In the proposed experiment, fused silica slides were sequentially implanted with couples of ion species, namely, Co^+ and Ni^+ , Co^+ and Cu^+, at total fluences in the 6 to $30*10^{16}$ ions/cm^2 range, and energies from 90 to 180 keV. Also, silica slides were coated via sol-gel dip-coating method, then annealed either in air or in reducing atmosphere at different temperatures. For each technique, different samples were prepared to cover the Co:Ni composition range. By these techniques, almost monodispersed nanostructures were obtained with particle size in the range from a few to several nanometers. Co:Cu (1:1) composites prepared by ion implantation exhibit a lower coercive force than single Co composites. In order to understand the origin of the magnetic features, it is of critical importance to determine clusters size and mean inter-cluster-correlation distance at every step of preparation. Since the layer rich in clusters is confined of nanoclusters, with mean sizes and mean inter-particle correlation distances in the 1-10 nm range. Intercluster correlation signal was clearly evidenced in most of the samples. In particular, in the case of samples implanted with Cu and then Co ions (samples CuCo), high cluster density in a thin layer was observed, while for reversed implant order (samples CoCu), an isotrope distribution of clusters in the implanted region was observed. In the Figure 1, collected GISAXS patterns are shown for samples implanted to 6+6*10^{16} ions/cm^2 fluence, namely, CuCo (left), and CoCu (right).

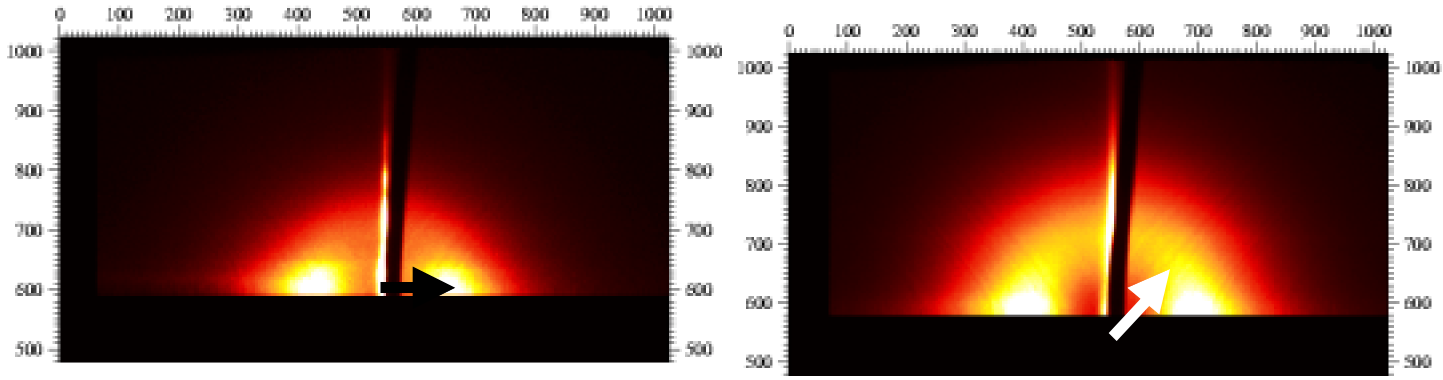

Fig. 1. GISAXS patterns for CuCo (left) and CoCu samples (right). Intercluster correlation ring is clearly visible.

Publications

F. D'Acapito, F. Gonella, C. Maurizio, E. Cattaruzza, S. Padovani, G. Mattei, in preparation.