ESRF	**Experiment title:** Small angle scattering under conditions of specular reflection by multilayer gratings and terrace superlattices	**Experiment number:** HS-936
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Report:

The experiments within this proposal have been devoted to small angle scattering in the reflection geometry from planar and structured layered samples. The main studies were performed on amorphous lateral multilayer gratings and magnetic planar multilayers, while preliminary studies of a copper clusters doped in a single-layer phthalocyanine layer were managed as well. The experiment profited from the advantages of the ID1 beamline: simultaneous use of 0D scintillation detector and 2D gas-filled detector operating in vacuum, and the possibility of energy change (from 1.0 to 1.66 Å in our case).

Firstly, we used the technique of coplanar and non-coplanar x-ray reflectivity in order to perform structural studies of an amorphous W/Si periodic multilayer surface grating (vertical period 8 nm, lateral period 800 nm, wire width to lateral period ratio 5:8). We concentrated on the measurement with the plane of incidence parallel to wires, which excites both, coherent and incoherent (diffuse) scattering (well resolved on the 2D image, see figure 1). The latter is represented by horizontal resonant diffuse scattering (RDS-) sheets, while the former is observed as an arc of simultaneously excited grating truncation rods with the circular profile given by the sample structure and sidewall quality (P. Mikulík and T. Baumbach, in preparation).

The second set of studied samples were planar magnetic multilayers grown by magneto- sputtering based mainly on alloys of Ni, Co and Fe. The measurements were performed at two different energies: below the Co and Fe absorption edges which enhanced the sensibility to different interfaces in the sample increasing the contrast. One of the samples was measured, annealed and remeasured afterwards. Comparison of the diffuse scattering images shows qualitative differences in the incoherent scattering before and after annealing attributed to the changes of the interface morphology (figure 2, diffuse intensity before annealing). The quantitative fit of the layer setup and interface properties will help to understand changes in the giant magnetoresistance in these samples after a heating procedure.

Finally, we studied a single-layer sample with a thick crystalline phthalocyanine layer slightly damaged by doping of copper atoms, which form clusters with the size of at about 5 nm. The clusters are indicated by the recorded 2D images, see figure 3, where from the cluster size and correlation properties can be obtained. Furthermore, the short wavelength used and the high flux at ID1 enabled to measure the crystal truncation rod scattering until higher angle of incidence which has shown diffraction from the phthalocyanine lattice, an effect which cannot be well resolved using laboratory sources.

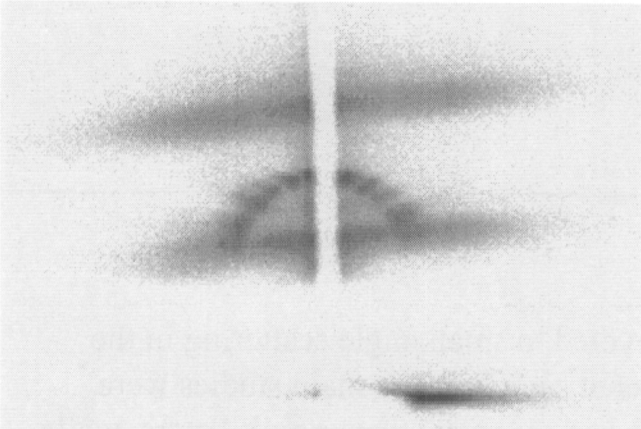

Figure 1. Coherent and diffuse scattering.

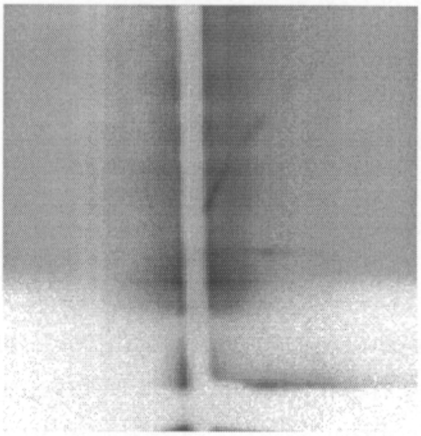

Figure 2. Diffuse scattering.

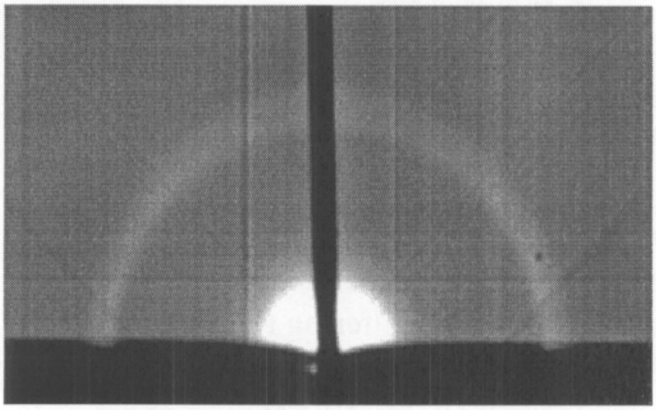

Figure 3. Scattering by copper clusters.