ESRF	**Experiment title:** Preferred orientations and shear stress in polycrsystalline cobalt under high pressure	**Experiment number:** HS-1905
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Shifts: 12	**Local contact(s):** M. Hanfland	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

- *S. Merkel, Laboratoire des Sciences de la Terre, ENS Lyon, 69364 Lyon Cedex 07, France
- *G. Fiquet, J. Badro, Laboratoire de Minéralogie Cristallographie, Université Paris VI, IPGP, F-75252 Paris Cedex 05, France.
- *D. Antonangeli, ESRF, France

Report:

The goal of this experiment was to obtain information on the texture and shear strength of polycrystaline cobalt in compression under high pressure and ambient temperature using the diamond anvil cell as a deformation apparatus.

Finely grained polycrystaline cobalt was loaded in an x-ray transparent gasket made of a mixture of amorphous boron and expoxy. The pressure, monitered using the ruby scale, was increased up to 30 GPa. All along the pressure increase we performed diffraction with the x-ray beam perpendicular to the load axis in order to analyse the state of stress and texture in the sample. The variations of the measured d-spacings with χ, the angle between the diffracting plane normal and the compression direction, provide information on non-hydrostatic stress and elasticity in the sample while the variations of the diffraction intensities with orientation are related to texture [1].

Figure 1 presents the variation of diffraction intensities with orientation measured for pressure between 0 and 8.7 GPa for the (100) and (002) peaks of Co. We observe the development of a very strong texture with the (002) planes aligned in a direction orthogonal to the compression axis at high pressure. Comparison between those figures, results from polycrystalline plasticity modeling, and measurements on hcp-Fe under the same conditions [2,3] will allow us to better constrain the deformation mechanisms of hexagonal metal under high pressure.

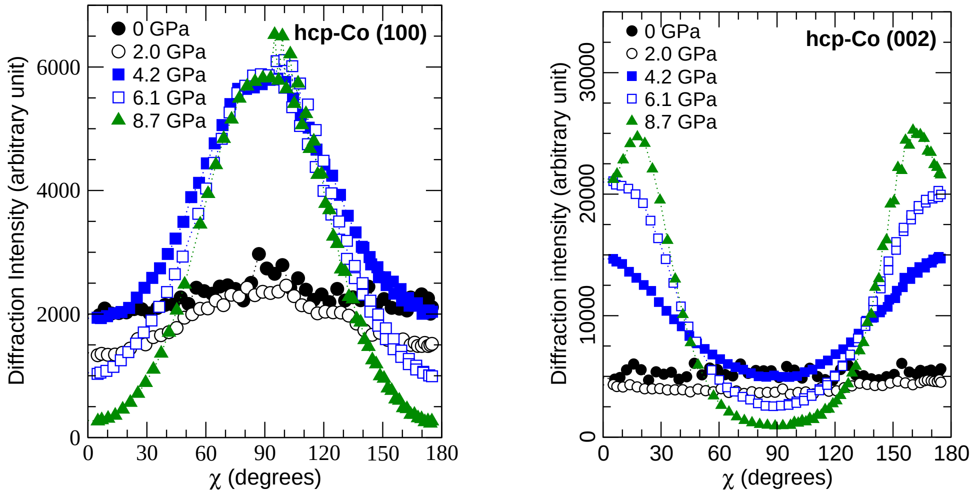

Figure 1: Diffraction intensity vs. orientation of the diffracting plane for the (100) and (002) peaks of Co at P=0, 2.0, 4.2, 6.1, and 8.7 GPa. At low pressure, we observe very small variation of diffraction intensity with orientation. At the highest pressures, diffraction intensity for the (100) peak is maximum for $\chi = 90°$ (planes parallel to the compression). For the (002) peak, diffraction intensity is maximum at $\chi = 0°$ and $\chi = 180°$ (planes orthogonal to the compression axis).

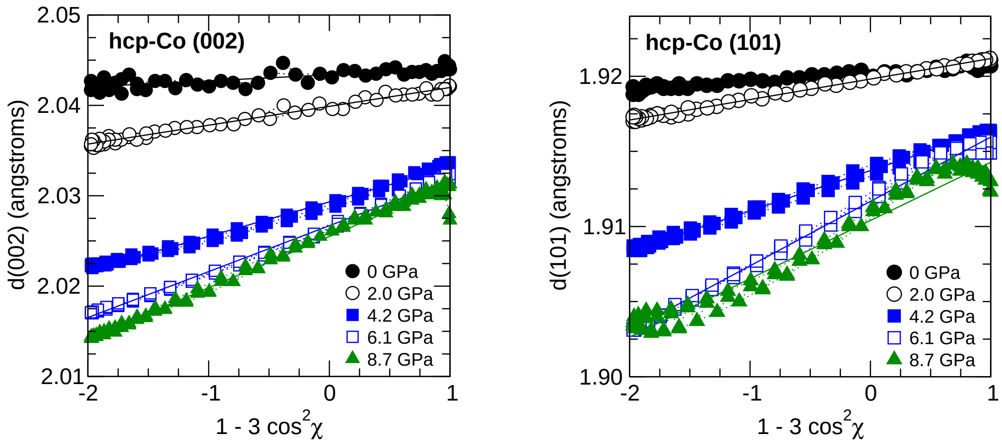

Figure 2: Measured d-spacings vs. orientation for the (002) and (101) peaks of Co at P=0, 2.0, 4.2, 6.1, and 8.7 GPa. Solid lines are linear least-square fits to the data.

Figure 2 presents the variation of the measured d-spacings with orientation for the (002) and (101) planes of Co at different pressures. These data can not be used to extract the exact stress conditions and information on the elastic moduli of the sample in the experiment. The high precision of these measurements should also allow us to constrain the effect of lattice preferred orientations in the analysis. This had not been successful with previously measured data [4].

References:

[1] S. Merkel *et al.*, J. Geophys. Res., **107**, 2271 (2002)

[2] H.R. Wenk *et al.*, Nature, **405**, 1044 (2000)

[3] S. Merkel *et al.*, unpublished

[4] S. Matthies *et al.*, Earth Planet. Sc. Lett., **194**, 201 (2001)