



	Experiment title: Valence states of iron and titanium in synthetic sapphires	Experiment number: HE-3214
Beamline: ID26	Date of experiment: from: 3 february 2010 to: 10 february 2010	Date of report: 20-02-13
Shifts: 18	Local contact(s): Dr. Pieter Glatzel	<i>Received at ESRF:</i>
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Report:

The goal of the experiment was to investigate the valence states of iron and titanium in synthetic sapphires grown under different oxidizing or reducing atmosphere. However, despite our efforts, the samples that we had collected and previously characterized using optical absorption spectroscopy turned out to be of insufficient homogeneity for the x-ray experiments. From the XAS spectra it was very clear that the local structure around the absorbing ion was dependent on the spot chosen on the sample. We attribute this to the existence of some clustering / segregation effects during the synthesis. Therefore, after trying several samples, we concluded that we would not be able to collect reliable data using this collection of samples, since small variation of beam position could significantly change the shape and intensity of the pre-edge. Thus, we decided to use the beamtime for another project.

Instead, we performed 1s2p RIXS-MCD measurements at the Fe K edge in several thin magnetite and iron films grown on MgO(001). The goal was to assess the sensitivity of RIXS-MCD to probe the magnetization of buried thin films and discuss its advantages in terms of an application to multilayer systems. Additionally, we performed test experiments on a single crystal of magnetite and measured hysteresis loops using RIXS-MCD. These measurements were later improved in November 2010 (see HE3503 experimental report) and performed on thin buried layers of magnetite. The results were presented during several conferences (see below) and published in Journal of Applied Physics.

M. Sikora, A. Juhin, G. Simon, M. Zając, K. Biernacka, Cz. Kapusta, L. Morellon, M. R. Ibarra, and P. Glatzel, 1s2p resonant inelastic x-ray scattering-magnetic circular dichroism: A sensitive probe of 3d magnetic moments using hard x-ray photons, **Journal of Applied Physics** 111, 07E301 (2012).

M. Sikora. 56th conference on Magnetism and Magnetic Materials, Scottsdale, Arizona (USA), 30 October–3 November 2011,

A.Juhin. Workshop on Fundamental Aspects of X-ray Spectroscopies: the role of the 2p core hole in XAS and RIXS. Utrecht (Netherlands), 20-21 february 2013.

A.Juhin. CTM4XAS 2012 Winter School, Utrecht (Netherlands), 13-14 february 2012. Application of Ligand Field Multiplet Theory to the calculation of dichroisms.

A.Juhin. The Electronic Structure of Transition Metal Systems, Utrecht (Netherlands), 21 october 2010. Strong K-edge Magnetic Circular Dichroism detected by Resonant Inelastic X-ray Scattering.