

Magnetic domain imaging using X-ray linear dichroism

Using a ferrimagnetic Fe_3O_4 natural single crystal, first images with X-ray magnetic linear dichroism contrast (XMLD) have been obtained in Photo Emission Electron Microscopy (PEEM) at CIRCE. Although the XMLD effect is typically much weaker in ferromagnetic materials than the more commonly used circular dichroic effect (XMCD), it is a unique tool when it comes to the investigation of antiferromagnetic systems without net magnetic moment.

Figure 1 below shows two dichroic PEEM images (field of view 20 μm), using the XMCD and XMLD effects as magnetic contrast mechanisms. On the left, using XMCD at the Fe-L_3 absorption edge, the dominating four-fold anisotropy of the Fe_3O_4 crystal can be appreciated. The intensity grey scale corresponds to the magnetization orientation relative to the incoming x-ray beam as indicated by the inset arrow. The right image was taken using linear horizontal polarized x-rays at two different energies at the Fe-L_2 absorption edge. For the same magnetization pattern as in the left image, the different angle dependence of the XMLD effect results (inset arrow) results in the same color for antiparallel domains.

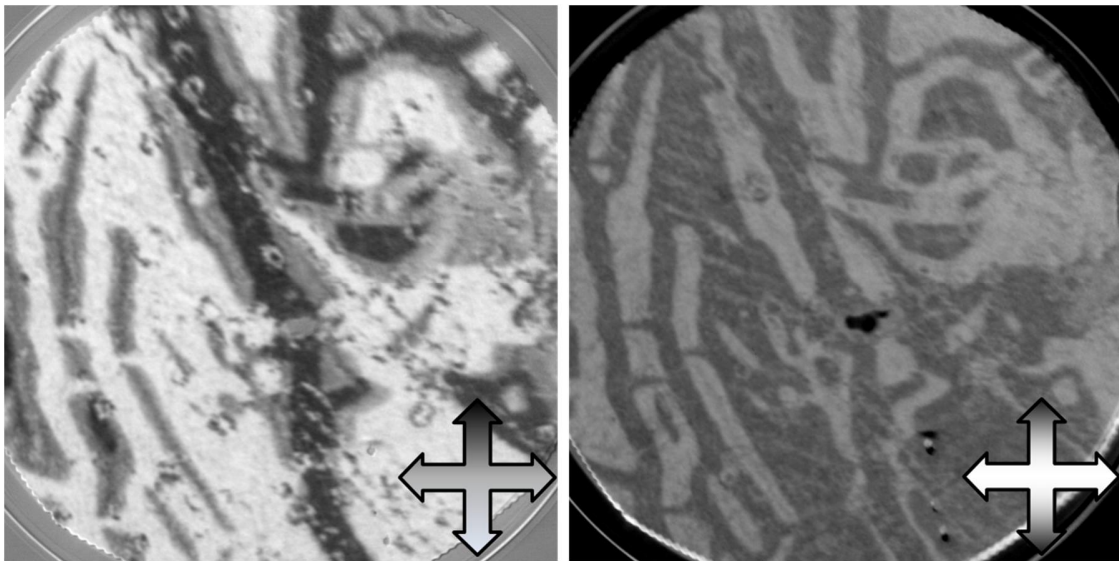


Figure 1: XMCD (left) and XMLD (right) magnetic microscopy images of the same zone in a Fe_3O_4 single crystal (sample courtesy of A.K. Schmid and Juan de la Figuera). The PEEM images (field of view 20 μm) were taken at the CIRCE beamline using photons with either circular or linear horizontal polarization tuned to the Fe-L_3 (XMCD) and Fe-L_2 (XMLD) absorption edges. The intensity grey scale represents the orientation of the magnetization as indicated by the inset arrows.