



Experiment title: Anisotropic anomalous scattering from HoFe₂		Experiment number: 20-01-36
Beamline: BM 28	Date of experiment: from: 14/7/99 to: 20/7/99	Date of report: 5/4/00 <i>Received at XMaS:</i>
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Report:

We report measurements of glide-reflection-forbidden diffraction from cubic HoFe₂ (Fd-3m) in the vicinity of the Fe K-edge. Both the energy and polarization dependence have been investigated at the 002 and 024 Bragg positions, using the XMaS beamline.

While the cubic space group of HoFe₂ rules out anisotropic absorption (at least, within the dipole approximation), the fact that the *site* symmetry of the Fe atoms (-3m) is not cubic allows for the manifestation of anisotropic scattering as intensity at forbidden crystal settings. The resulting intensity arises from the difference in oscillator strength along the three-fold axis and perpendicular to it, leading to an unusual energy spectrum (Figure 1).

Another important feature of this process is that the diffraction tensor

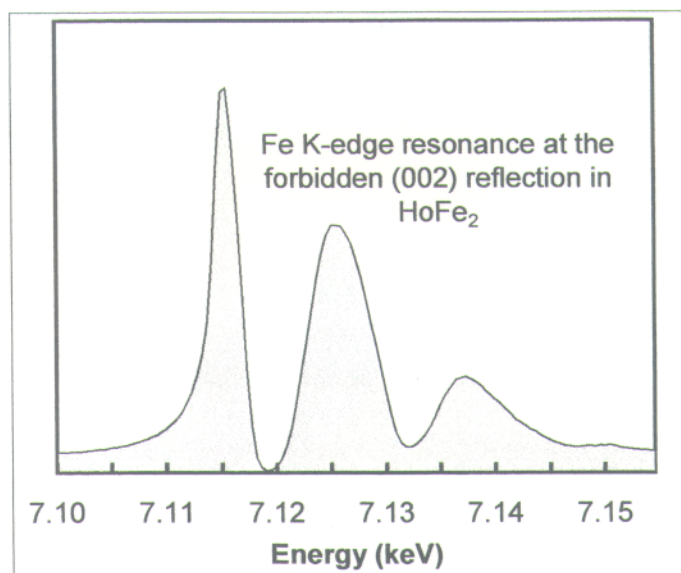


Figure 1. Energy spectrum of the 002 'forbidden' reflection in HoFe₂, close to the Fe K-edge.

contains only off-diagonal terms, and therefore exhibits a distinctive polarization dependence, with significant mixing of the σ and π polarization channels.

We find that the 002 and 024 ψ -scan intensities, taken with four settings of a Cu 220 linear polarization analyser, are well described by a model based on a dipole-dipole (rank-two) atomic scattering tensor.

No evidence was found for contributions from higher-order tensors, and no signal observed from the cubic Ho sites (above the level of the multiple-diffraction background) near the Ho L-edge resonances.

Measurements of this kind are important, not only from a basic physics perspective [1-4], but also in order to appreciate the limitations of interpreting resonant anomalous diffraction with an isotropic scattering model, and, potentially, for partial-structure analysis [5].

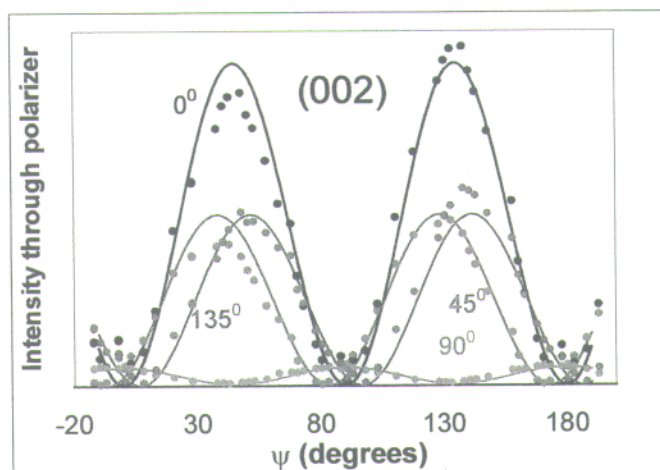


Figure 2. 002 ψ -scan intensities at the Fe K-edge, taken with a linear polarization analyser oriented at four different angles with respect to the scattering plane. The solid lines are calculations based on a dipole-dipole (rank-two) scattering tensor.

References

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