

ESRF

Experiment title:

Magnetic Circular Dichroism in Soft X-Ray
Scattering from Fe-Co Alloys

Experiment

number:

HC-161

Beamline:

BL26

Date of experiment:

from: 5/7/95

to: 20/7/95

Date of report:

19/3/96

Shifts:

37

Local contact(s):

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Report:

We have measured the energy spectra of the radiation scattered in magnetic samples of disordered Fe-Co alloys excited with circularly polarized monochromatic radiation at the L3 and L2 absorption peaks of the two components. The band pass is around 2.5 eV in the excitation channel and 1 eV in the scattering channel. This has been done by installing at the end of BL26 a fluorescence spectrograph based on a grating and equipped with a dedicated refocusing optics to match to the BL. We have measured the edges in alloys having a variety of compositions with interesting magnetic properties : Fe₉₈C₀₂, Fe₉₀C₀₁₀, Fe₈₀C₀₂₀, Fe₂₀C₀₈₀, Fe₁₀C₀₉₀, Fe₅C₀₉₅, Fe₂C₀₉₈. The dichroism in the scattering mode is defined as the difference between the spectra obtained by reversing, in the excitation channel, the relative orientation of the photon helicity and of the magnetization. A selection of results is given in the figure where we summarise the raw Fe-L3 data (left hand panel) in a variety of alloys and the scattering cross sections (right hand panel) derived from the data analysis. The difference spectra are shown as solid lines. The bold solid line in the right hand panel is corrected for the degree of polarisation of the X-rays. The upper panel shows the corrected (open symbols) and uncorrected (filled symbols) for the corresponding X-ray absorption MCD measurements at the L3 edge.

This is the first systematic research on the subject carried out at the ESRF. These results add important new information on the subject, which was in the early development stage at the time of the experiment, in particular we mention :

- the development of a reliable procedure to analyse the data in order to obtain the cross sections
- the evidence of strong dichroism in diluted systems
- the demonstration that this method can be very problematic in concentrated systems due to the very small dichroism and
- the good correlation between the magnetic properties and the measurements suggested by the cross sections (mainly in the diluted case).

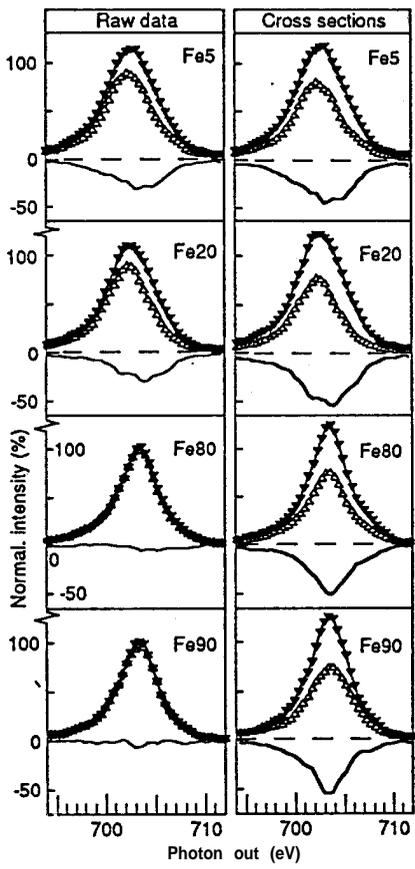


Figure 1: X-ray emission spectra for Fe-Co alloys. (See text for details).