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Element Specific Magnetometry Combining X-ray Circular with Linear Dichroism: Fundamentals and Applications

I.A. Kowalik

Institute of Physics, Polish Academy of Sciences, al. Lotników 32/46, 02-668 Warsaw, Poland

In the original article two references in Secs. 3.1 and 3.2 have been accidentally omitted by author. To include those *post scriptum*, a short introduction should be added to this section.

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3. X-ray absorption spectroscopy with a magnetic contrast

In this section the focus is on the measure and analysis of the soft X-ray absorption of magnetic solids. The measure of the X-ray absorption coefficient in the soft X-ray range, presents special challenges, given the limited penetration of soft X-ray photons into a typical solid. The limited soft X-ray photon penetration does not allow for the use of the typical transmission geometry as for hard X-rays. The X-ray absorption coefficient is then recorded using a secondary channel. In the soft X-ray domain under ultra high vacuum conditions one often records the photocurrent of the sample. As in X-ray absorption spectroscopy experiments one analyses spectral intensities, it is important to discuss the conditions under which the chosen secondary channel is proportional to the absorption coefficient. A discussion is needed on the probing depth of the chosen secondary channel versus the penetration length of the X-rays. For the soft X-ray domain several references have already provided detailed discussions. As here the magnetism of 3d elements in thin and ultra-thin film form is discussed, special attention is given to a selection of references from this experimental area, which already did present own experimental data as well as a discussion of possible ways to recognise and correct possible non proportionality effects between the secondary channel and the absorption coefficient [+1 Persson, +2 Hahlin, 13, 15]. Some of the original discussion in these references, after being introduced (Secs. 3.1 and 3.2), is expanded and used in the further part of the Sec. 3. Section 3.3 introduces X-ray magnetic dichroism and highlights the importance of an appropriate intensity analysis of spectral areas to obtain magnetic information. The data interpretation has been adapted to the needs of soft X-ray polarimetry after an intensity analysis of the X-ray absorption spectral areas (Sec. 3.4) using an own set of data. Properly quantifying the absorption coefficient, furthermore allows for the detection of small X-ray linear dichroism effects at the Fe L-edges (Sec. 3.5) and small dichroic effects at the N K-edge of Fe doped GaN films (Sec. 3.6). The experimental results and discussion in Secs 3.4, 3.5 and 3.6 are based on the own set of data.

References

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