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IT-5-P-1781 Effect of the asymmetry of dynamical electron diffraction on intensity of acquired EMCD signals

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One of the most challenging issues to characterize magnetic materials in the transmission electron microscopy is to obtain quantitative magnetic parameters on the nanometer scale. By the technique of electron energy-loss magnetic chiral dichroism (EMCD) is proposed and applying the sum rules, it is possible to quantitatively extract the orbital to spin magnetic moment ratio mL/mS with high spatial resolution. Compared with the technique of XMCD, the detection source of EMCD technology are the transmission electrons rather than the X-ray based on the precious synchrotron radiation. Therefore, the dynamical diffraction effects of electrons are quite remarkable in the periodic crystal structures, making the quantitative EMCD technique more complicated. By establishing the quantitative relation between EMCD and dynamical diffraction effects, spin and orbital moment of different elements and nonequivalent crystallographic sites are quantitatively determined in a spinel structure NiFe2O4 [1].
However, the diffraction geometry in EMCD experiment is strict and conditions of symmetric detector positions should be fulfilled. It has been reported that the inherent asymmetry of the two-beam geometry can lead to systematic errors in quantitative EMCD measurements [2]. Besides, the asymmetry of dynamical coefficients in the three-beam geometry also exists and is neglected in the previous study. Here, we point out that the asymmetry of dynamical electron diffraction should be accounted and its impact on the quantitative measurements of the EMCD signal needs to be evaluated.
Reference:
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