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Analysis of the crystal electric field ground state of intermetallic $TbRhIn_5$ by using soft X-ray absorption spectroscopy

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Magnetic properties of rare earth ions are due to localized 4*f* electrons. The Crystal Electric Field (CEF, the static electric potential due to surrounding ions) acts as a perturbation potential and is responsible for breaking the degeneracy of the $2J+1$ multiplet in the ground state of those ions. In this work we present the results and discussion of the linear-polarization soft X-ray spectroscopy (LPXAS) data collected at the Tb M_4 and M_5 edges of the $TbRhIn_5$ intermetallic compound. $TbRhIn_5$ is an antiferromagnetic (AFM) compound with Néel temperature $T_N \sim 46$ K and the CEF influences in its magnetic properties (T_N and microscopic magnetic structure) were studied by means of a mean field model [1]. The data were taken at the PGM and SXS beamlines of the Brazilian synchrotron lightsource (LNLS). By comparing to the theoretical spectra calculated within the multiple scattering approximation of the MultiX platform [2], we aim to experimentally study the influence of the perturbing electric potential on the $TbRhIn_5$ ground state. Figure 1 shows a comparison between experimental and theoretical XAS spectra at the Tb M_4 and M_5 edges with light polarized perpendicular ($\mathbf{E}_\perp$) and parallel ($\mathbf{E}_\parallel$) to the crystallographic **c**-axe. This work is the first attempt to use LPXAS in the experimental study of the CEF influence on the ground state symmetry of the rare earth based compounds from the $R\mathrm{RhIn}_5$ (R = Ce - Ho) family at the Brazilian lightsource.

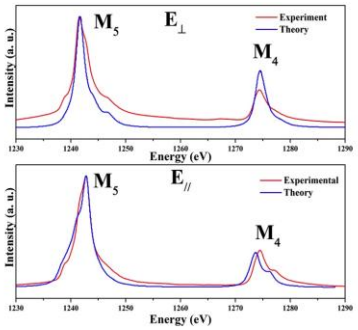

Figure 1 - Comparison between experimental and theoretical XAS spectra at Tb M_4 and M_5 edges with light polarized perpendicular ($E_\perp$) and parallel ($E_\parallel$) to the crystallographic c-axe.

[1] R. Lora-Serrano *et al.*, Phys. Rev B 74, 214404 (2006).
[2] A. Uldry, F. Vernay and B. Delley, Phys. Rev B 85, 125133 (2012).

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