ESRF	**Experiment title:** XMCD measurements on RE-TM single crystals.	**Experiment number:** HE - 326
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Report:

XMCD experiments have been performed at the rare earth $L_{2,3}$ and 3*d* metal K-edge on single crystals of $GdNi_5$ $TbNi_5$ and $HoCo_2$ ferromagnetic compounds (TC = 32 K, 23 K and 78 K in $GdNi_5$ $TbNi_5$ and $HoCo_2$ respectively). Experiments were performed at 12 K for Gd-, $TbNi_5$ and 20 K for $HoCo_2$. A magnetic field of 3 T applied along the easy magnetization direction allows to obtain a single domain phase in the samples. Since the samples are bulk single crystals, the total fluorescence detection mode was used.

The RNi_5 compounds crystallize in the simple hexagonal $CaCu_5$-type structure with the rare earth in a high symmetry position (6/mmm). The ***3d*** shell of Ni is almost full and its contribution to magnetism is small. The magnetic properties come essentially from the rare earths. These compounds, widely investigated in the past, appear as well suited compounds to improve our knowledge of the XMCD at the R $L_{2,3}$-edges.

I. The XMCD spectra present huge and well structured dichroic signals at both the R $L_{2,3}$ and the Ni K-edges. In $TbNi_5$ structures due to the quadrupolar ($2p \rightarrow 4f$) transitions (E_2) are clearly observed, about 5 eV below the edge, in both the Tb L_2 and L_3-edge dichroic spectra. At the Gd L_3-edge the small negative structure below the edge can also be attributed to the E_2 contribution. In addition a positive structure approximately at 7 eV above the edge is observed. These structures were not observed in previous measurements on powdered samples. At the Gd La-edge the structure above the edge has evolved in a well resolved negative peak, while no clear structure below the edge is resolved. Nevertheless the asymmetry at the bottom of the main negative peak reveals that a E_2 contribution is still present.

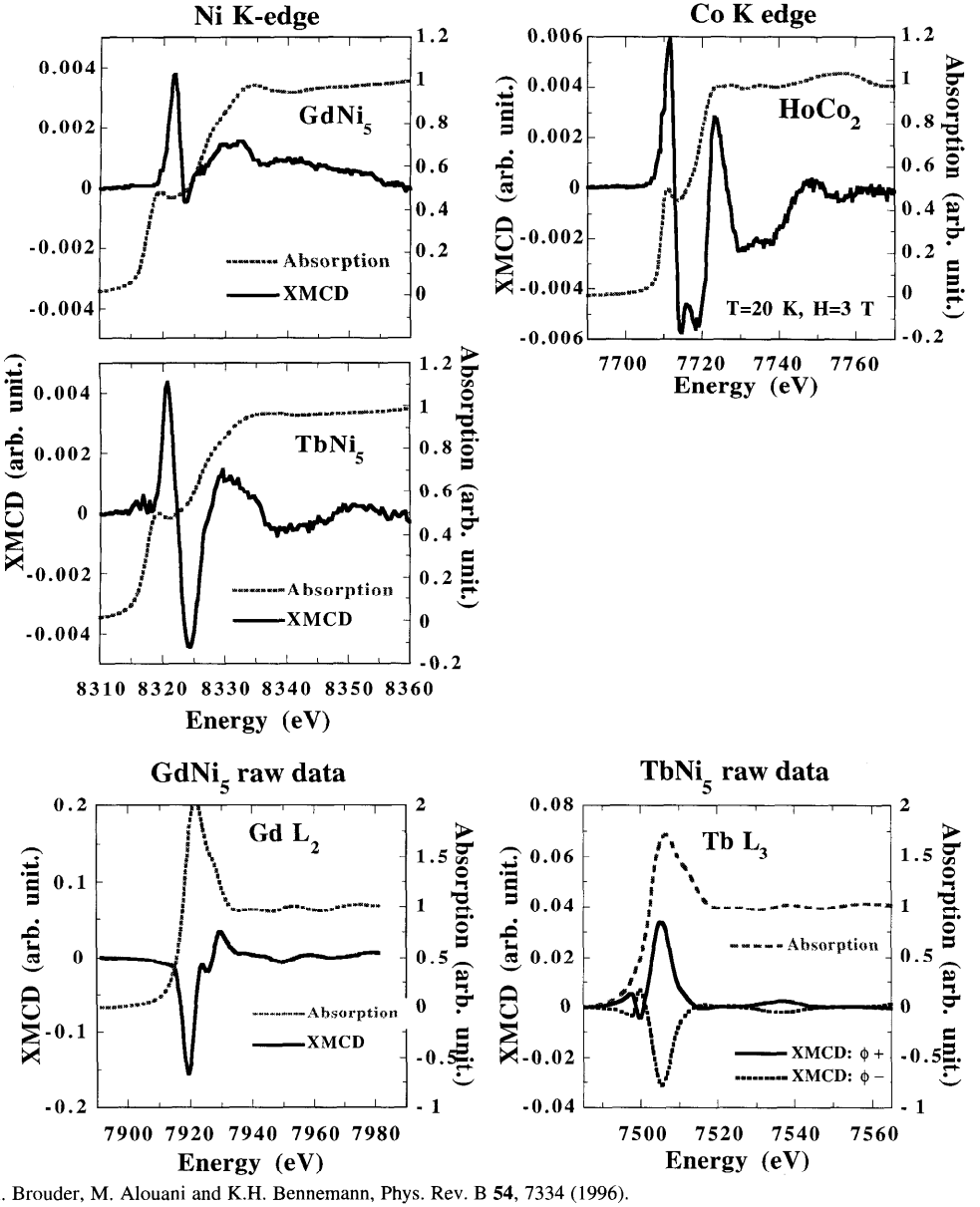
II. At the Ni K-edge the dichroic spectra have a three-peak structure: positive, negative and then positive. The first positive peak has the same intensity in $GdNi_5$ and $TbNi_5$, while the negative one is strongly reduced in the Gd compound. Surprisingly the XMCD signals present a huge intensity (up to 0.4%) compared to the signals observed so far at the K-edge of pure Ni metal and even at K-edge of Fe or Co metal. The large peak intensities and their evolution between the Gd and the Tb compounds show up the strong influence of the rare earth on the structure of the dichroic spectra at the Ni K-edge .

$HoCo_2$ crystallizes in the cubic Laves phase structure. At low temperatures, $\mu_{Co} \approx 1\ \mu_B$.

I. At the Ho $L_{2,3}$-edges, the XMCD spectra are polluted by the fluorescence of the Co K-edge. Corrections and analysis of the spectra are not completely finished.

II. At the Co K-edge a huge, up to 0.6%, and well resolved signal is observed. It exhibits a three-peak structure, very similar to the one observed in the RNi_5 compounds, but with a small positive structure in the

middle of the negative one. Recent studies at the Co K-edge in the RCo_5 compounds have shown that for magnetic rare earths, the Co K-edge dichroic spectra present the same three peak structure. In these compounds the Co has a strong magnetic moment, $\mu_{Co} \approx 1.5 \mu_B$. The calculations of the Co K-edge spectra, using the multiple-scattering framework proposed by Brouder *et* al.[1], have shown that in $TbCo_5$ the first peak comes almost exclusively from the scattering of the photoelectron by the spin-orbit of the neighbors and that the scattering by the Tb ***d*** shells dominates[2]. Presents results show that the XMCD structure is apparently independent of the strong or weak magnetic moment of the ***3d*** metal. Calculations are under way. These experimental results have been presented at the 10th. International Conference on X-ray Absorption Fine Structure in Chicago (August 1998).



[1] Ch. Brouder, M. Alouani and K.H. Bennemann, Phys. Rev. B **54**, 7334 (1996).

[2] J.P. Rueff, R.M. Galéra, Ch. Giorgetti, E. Dartyge, Ch. Brouder and M. Alouani, (1998) submitted to Phys.