X-ray magnetic circular dichroism at rare-earth L\textsubscript{2,3} absorption edges in various compounds and alloys

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Recent progress in techniques of synchrotron light sources has enabled us to study many phenomena which had been barely observable up to now. Among these, the X-ray magnetic circular dichroism (XMCD) in the X-ray absorption spectroscopy (XAS) in various materials displays a unique and powerful ability to reveal detailed information on electronic and magnetic properties of a selected atom and even a selected shell. A theoretical interpretation of the XMCD at rare-earth (called R hereafter) L\textsubscript{2,3} absorption edges is reviewed using differing models depending on the material under investigation. In a first part we present an overview of the recent developments of XMCD in XAS with general remarks, especially at R-atom absorption edges. Then we discuss two examples of XMCD spectra in:

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\item[(i)] RFe\textsubscript{2} Laves-phase compounds, using a tight-binding approximation for R 5d and Fe 3d conducting states, and (ii) R\textsubscript{2}Fe\textsubscript{14}B metallic compounds, with the help of a cluster model. The good agreement for R\textsubscript{2}Fe\textsubscript{14}B suggests that a cluster model provides a valuable method to quantitatively calculate XMCD spectra of R systems, even with quite complicated atomic arrangements. Actually we essentially focus our talk on the special case of Ce-systems, related to XAS and XMCD studies at the Ce L\textsubscript{2,3} edges. Two clearly differing cases are presented both from experimental and theoretical points of views: (i) A well localized 4f\textsuperscript{1} system, i.e. Ce Ru\textsubscript{2}Ge\textsubscript{2} (ii) A less localized 4f\textsuperscript{1} system, i.e. CeFe\textsubscript{2}, with a 3d partner. Also we investigate the influence of substitution on the low temperature properties of CePd\textsubscript{3} : Ce(Pd\textsubscript{1-x}Ni\textsubscript{x})\textsubscript{3} with x taken up to about 0.25. Moreover the Ce L\textsubscript{2,3} XMCD signal measured in CePd\textsubscript{3} demonstrates that in the Ce based dense Kondo materials, only the 4f\textsuperscript{1} channel gives a magnetic response. At last we give another example : Ce(Pd\textsubscript{1-x}Mn\textsubscript{x})\textsubscript{3} where x is about 0.03 giving rise to (CePd\textsubscript{3})\textsubscript{8}Mn where Mn sublattice undergoes a ferromagnetic transition and where Ce ions form a dense Kondo lattice and are in a paramagnetic state.
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