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Element specific magnetic moments of gadolinium iron garnet probed by soft-x-ray magnetic circular dichroism (abstract)

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The element specific magnetic moments of Gd and Fe in a gadolinium iron garnet ($\text{Gd}_3\text{Fe}_5\text{O}_{12}$) were probed at various temperatures by measuring the soft-x-ray magnetic circular dichroism (SXMCD) at the Gd $M_{4,5}$ and the Fe $L_{2,3}$ adsorption edges in an external field of 5 kG. The soft-x-ray absorption spectra were recorded with the photocurrent method using highly circularly polarized soft x rays recently obtained at the AT&T Bell Laboratories Dragon synchrotron radiation beamline.¹ The temperature dependence of the SXMCD signal at each edge allows one to independently determine the magnetic ordering of each specific ion. Our individually probed magnetic moment of the Gd^{3+} ion and of the two Fe^{3+} ions in different sites confirm the earlier calculations which predict a reversal of the local magnetic orientation at ~ 280 K. This work demonstrates that SXMCD is a valuable tool for probing the element and site specific magnetic properties of multicomponent systems. The applications of this novel technique to the investigation of transition metals and rare earths in ferromagnetic alloys, compounds, disordered, and impurity systems will be addressed.

¹C. T. Chen, F. Sette, Y. Ma, and S. Modesti, *Phys. Rev. B* **42**, 7262 (1990).

²R. Pauthenet, *J. Appl. Phys.* **29**, 253 (1958).