MAGNETISM AND ELECTRONIC STRUCTURE OF FERROMAGNETIC Gd BISMUTHIDES AND SILICIDES

J. Szade, M. Drzyzga and G. Skorek

Institute of Physics, University of Silesia, Uniwersytecka 4, 40-007 Katowice, Poland

9.7 cm

Gd_4Bi_3 and Gd_5Si_4 exhibit the highest ferromagnetic order transition (~335 K) among the Gd compounds with nonmagnetic elements. Their magnetic susceptibility was investigated in a large temperature range and the limited applicability of the Curie-Weiss law was found. A temperature dependent susceptibility of the Gd 5d electrons is suggested as a possible source of the nonlinear inverse susceptibility in the temperature range above T_C. We investigated also the Gd_5Bi_3, which shows 2 magnetic transitions below 270 K. The electronic structure of both bismuthides was studied with use of x-ray photoelectron spectroscopy (XPS). The valence band of Gd_5Bi_3 exhibits, in the vicinity of the Fermi level, similar features to the described earlier antiferromagnetic GdBi, whereas for the ferromagnetic Gd_4Bi_3 the shape of the photoelectron energy distribution curve is different. It shows a maximum at binding energy of about 2 eV and a feature at 0.5 eV. A similar shape was obtained for Gd_5Si_4 and one can relate the ferromagnetism in those compounds with a particular energy distribution of the Gd 5d electrons mediating the coupling between the 4f moments. The chemical shift of the core levels and possible charge transfer were also analysed.

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Corresponding author :
J. Szade

Address for correspondence :
Institute of Physics, University of Silesia
Uniwersytecka 4
40-007 Katowice

Email address :
szade@us.edu.pl