Magnetism and electronic structure of some rare earth-based intermetallics

Ł. Gondek[1], M. Bałanda[2], J. Żukrowski[1], R. Zalecki[1], A. Kołodziejczyk[1], D. Kaczorowski[4], and A. Szytuła[4]

[1]*Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, 30-059 Kraków, Poland*
[2]*The H. Niewodniczański Institute of Nuclear Physics, Polish Academy of Sciences Radzikowskiego 152, 31-342 Kraków, Poland*
[3]*W. Trzebiatowski Institute of Low Temperature and Structure Research Polish Academy of Sciences, 50-950 Wrocław, P. O. Box 1410, Poland*
[4] *M. Smoluchowski Institute of Physics, Jagiellonian University Reymonta 4, 30-059 Kraków, Poland*

Intermetallic compounds of RTX (R- rare earth, T – *d*-electron metal, X – *p*-electron element) stoichiometry exhibit a great variety of interesting physical properties. It seems, that most of their magnetic properties can be associated to some features of the electronic structure such as hybridisation or mixed/fluctuating valence. In this contribution some correlations between magnetic behaviour and electronic structure of several RTX compounds are emphasised.

Rare earth-based compounds are investigated by means of structural, magnetometric, specific heat, X-ray and ultraviolet photoemission spectroscopy. It will be shown, that usage of many complementary methods is necessary in order to get some insight into complex magnetic phenomena. Magnetic behaviour of rare earth intermetallics is believed to be an effect of interplay between indirect RKKY exchange interactions and the Kondo screening of an magnetic ion (the case of cerium and ytterbium based alloys). This interactions are connected to density of states (DOS) at the Fermi level. The latter may be inspected using photoelectron spectroscopy. The DOS may be tuned by compound composition (stoichiometry), hydrogenation, applying external pressure *etc*. The above mentioned measurements techniques provide necessary experimental background for understanding a physics of magnetic intermetallics. In general, such experiments seem to be consistent with the Doniach diagram. It may be considered as a bit oversimplified, however from experimental point of view it is still very useful. Another factor, that must be taken into account is the crystalline electric field (CEF). It seems, that CEF effects together with hybridization of the *4f* states of rare earth with *d* states of T – element are responsible for magnetic behaviour in praseodymium and neodymium based compounds. On the other hand, for intermetalics with Gd – Er rare earths elements magnetic interactions are governed by RKKY interactions modified by CEF influence. While *4f* states of Gd – Er are localised deeply below the Fermi level, no effects connected with instability of *4f* shell is expected. Consequently most of such compounds exhibit magnetic ordering at least at sufficient low temperatures.

Name of the presenting author (oral): Łukasz Gondek
e-mail address: lgondek@agh.edu.pl
http://www.agh.edu.pl