XAFS studies of local structure peculiarities and magnetic ordering in $R_2Fe_{17-x}Mn_x$ (R = Ce, Lu) intermetallics

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Abstract:

For the first time the rearrangement of cerium local environment vs. Mn concentration and temperature was studied in $Ce_2Fe_{17-x}Mn_x$ intermetallics with the complex magnetic phase diagram [1] by means of EXAFS spectroscopy. The spectra were collected above the high-energy *K*-Ce (40443 eV) absorption edge so that they are not limited in length by the presence of another edges and contain more information on local structure. Simultaneously under the same conditions the Ce valence state was investigated by XANES spectroscopy at the L_3-Ce (5723 eV) absorption edge. The correlations are found between the changes of local crystal and electronic structure and the magnetic properties [2]. The interatomic distance Ce-Fe(Mn) feels the magnetic ordering both global in the whole sample and, probably, local in clusters with the short-range magnetic order. The Fe-Fe distance in Ce_2Fe_{17} and $Ce_2Fe_{15}Mn_2$ alloys at low temperatures is longer than 2.45 Å that leads to the ferromagnetic ordering in compounds. The Ce valence does not depend on temperature but depends on Mn concentration. In ferromagnets x=0,2 it is slightly bigger than in antiferromagnetic x=1. Valence indicates the hybridization between 4*f* and 3*d* electronic states which can affect the magnetic ordering in the system. The similar EXAFS study above the L_3-Lu (9244 eV) absorption edge of $Lu_2Fe_{17-x}Mn_x$ compounds with the similar structure but completely different magnetic phase diagram [3] also shows correlation between Fe-Fe interatomic distance and the type of magnetic ordering. The work is partially supported by RFFI (grant 11-02-01174-a).

References:

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