PL0400268

11.7 Electron Density and Potential Distribution in GaN from X-Ray Diffraction Experiment

by J.Waliszewski[1], L.Dobrzyński[1]

The method of the evaluation of the electrostatic potential in a crystal by X-ray diffraction is discussed. The distribution of the electrostatic potential in GaN is discussed with the reference to the charge distribution.

[1] Institute of Experimental Physics, University of Białystok, Lipowa 41, 15-424 Białystok, Poland

PL0400269

11.8 Modulated Magnetic Structure of $ScFe_4Al_8$ by X-Ray, Neutron Powder Diffraction and Mössbauer Effect

by K.Rećko[1], K.Szymański[1], L.Dobrzyński[1], D.Satuła[1], B.C.Hauback[2]

The ternary intermetallic $ScFe_4Al_8$ alloy presented in this paper belongs to the extensively investigated $ThMn_{12}$- type family, reviewed recently in Refs. [1, 2]. The diffraction investigations confirm the bct structure I 4/mmm (a~860 pm, c~499 pm at RT) in which four non-equivalent crystallographic sublattices are present. As was shown, the iron sublattice - (8f) in this family of alloys can exhibit very complicated magnetic properties [1]. Depending on the main metal at (2a) positions, uranium, thorium or scandium, the magnetic moments in Fe sublattice (8f) form double modulated spiral structure [1], spin-canted system [2] or a single-q spiral which we find for $ScFe_4Al_8$. In the latter alloy, in contrast to the one containing uranium or thorium, we could expect relatively low magneto-crystalline anisotropy. The unpolarized neutron diffraction pattern leaves no doubts that the modulated magnetic structure is observed in the tetragonal $ScFe_4Al_8$ compound. The interpretation of our neutron data requires the presence of non-zero magnetic propagation vector different from the nuclear one. The iron magnetic moments of $ScFe_4Al_8$ sample create a spiral structure with spins rotated in a plane parallel to the wave vector $q = (q_x, q_x, 0)$, with $q_x = 0.136(2)$ which is temperature independent up to 187 K. The value of the iron magnetic moment at 8 K is close to $1.08(12)\ \mu_B$. The basic magnetic cell has to be purely antiferromagnetic with iron spins directed along *a* or *b* axis and rotated in the basal plane by $49(1)^0$ from cell to cell. The antiferromagnetic nature of $ScFe_4Al_8$ is fully confirmed by Mössbauer measurements. The neutron data also show that scandium doesn't contribute to the magnetism of $ScFe_4Al_8$.

[1] K.Rećko et al., Phys. Stat. Sol. (2002) in press
[2] K.Rećko et al., J. Alloys Comp. 334, 1-2(2002)58

[1] Institute of Experimental Physics, University of Białystok, Lipowa 41, 15-424 Białystok, Poland
[2] Department of Physics, Institute for Energy Technology, P.O. Box 40, N-2027 Kjeller, Norway

PL0400270

11.9 Magnetic Properties of $Sc(FeAl)_{12}$ Samples by Powder Diffraction Techniques and Mössbauer Effect

by K.Rećko[1], K.Szymański[1], L.Dobrzyński[1], D.Satuła[1], B.C.Hauback[2]

X-ray and Neutron Diffraction techniques allowed us to determine crystalochemical structure of $ScFe_4Al_8$, $ScFe_5Al_7$ and $ScFe_6Al_6$ alloys with I 4/mmm symmetry, isostructural to $ThMn_{12}$ - type structure. Magnetic properties of $ScFe_4Al_8$ and $ScFe_6Al_6$ powder samples are presented. These alloys have been measured by means of conventional Mössbauer Effect (ME) as well as by Monochromatic Circularly Polarized Mössbauer Source (MCPMS). The results of Mössbauer experiments are compared with the neutrons data conclusions regarding the magnetic structure. $ScFe_4Al_8$ alloy orders around 250 K by forming antiferromagnetic spiral iron sublattice within the tetragonal basis plane ab and magnetic iron moment close to $1.1(2)\ \mu_B$ at 8 K.

[1] K.Rećko et al., Phys. Stat. Sol. (2002) in press
[2] K.Rećko et al., J. Alloys Comp. 334, 1-2(2002)58

[1] Institute of Experimental Physics, University of Białystok, Lipowa 41, 15-424 Białystok, Poland
[2] Department of Physics, Institute for Energy Technology, P.O. Box 40, N-2027 Kjeller, Norway