Contribution ID: **50** Type: **not specified**

Anisotropic magnetic properties and magnetic phase diagram of NdPd5Al2

Tuesday, 24 May 2016 11:15 (15 minutes)

We have investigated magnetic properties of the intermetallic $NdPd_5Al_2$ compound by means of specific heat and magnetization measurements, neutron diffraction and inelastic neutron scattering. The compound crystallizes in the tetragonal $I4/mmm$ space group with lattice parameters a =4.147 A and c =14.865 A, orders antiferromagnetically below T_N =1.3 K and presents large magnetocrystalline anisotropy due to the crystal-field effects. The magnetic phase diagram constructed on the basis of specific heat and magnetization measurements is characterized by two distinct magnetically ordered phases similarly to structurally related tetragonal RTX_5 and R_2TX_8 compounds. The zero-field antiferromagnetic phase is characterized by the propagation vector $k = (\frac{1}{2}00)$ and antiferromagnetic coupling of Nd moments along the tetragonal c-axis with the amplitude of magnetic moments of 2.22 μ_B/Nd as was revealed by neutron diffraction. The transition from the paramagnetic to magnetically ordered phase in zero field is the first-order phase transition. The crystal-field excitations in $NdPd_5Al_2$ were detected by means of inelastic neutron scattering at 3.0 meV, 7.4 meV, 8.6 meV and 17.1 meV. We further compare our findings about crystal field in $NdPd_5Al_2$ obtained from inelastic neutron scattering, susceptibility analysis and first-principles calculations and confront them with the experimental magnetization and magnetic specific heat data.

Sekce

Fyzika kondenzovaných látek

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Session Classification: Fyzika kondenzovaných látek