High-pressure influence on magnetic transitions of Ce_2Pd_2In intermetallic compound

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The physics of rare-earth element-based intermetallics is mainly determined by highly correlated 4f-electrons. In some compounds usually localized 4f-electrons states can hybridize with the wave functions of neighbouring atoms. The unique way how to directly affect the interatomic distances and thus the hybridization is application of external pressure.

In our study we have focused on the cerium-based compound Ce_2Pd_2In, which is known to crystallize in the Mo_2FeB_2-type structure (space group *P 4/m b m*), in the Shastry Sutherland lattice consisting of planes formed by Ce-atoms alternated by non-magnetic planes containing other elements. It belongs to the group of Ce_2T_2In compounds exhibiting, depending on the d-band of the transition metal *T*, well-localized magnetism (Ce_2Cu_2In, Ce_2Au_2In, Ce_2Pd_2In) or valence fluctuations (Ce_2Ni_2In, Ce_2Rh_2In) [1,2].

The magnetic ground state of this compound is very sensitive to the off-stoichiometry. The excess of Ce leads to ferromagnetic ground state, while the excess of Pd results in incommensurate antiferromagnetism with propagation vector k = (0.22, 0, 0). The accurate stoichiometry leads to presence of two magnetic transitions, the compound reaches ordered ferromagnetic ground state through the intermediate antiferromagnetic state [3,4,5].

We present the results of electrical resistivity and magnetic AC susceptibility measurements performed on a high quality Ce_2Pd_2In single crystal. A double-layer cylindrical pressure cell (made of CuBe and NiCrAl alloy) with nominal pressure range up to 3GPa was used. The sample was oriented along the tetragonal c-axis with respect to both - the electrical current and the magnetic field. Sensitivity to the applied external magnetic field was estimated. The *p-T* phase diagram (*Figure 1*) shows evolution of the characteristic temperatures of both ferromagnetic (T_C) and antiferromagnetic (T_N) phase transitions in dependence on applied hydrostatic pressure. The external pressure affects both observed transitions. While a slight pressure-induced shift of T_N to higher temperatures is observed, AFM phase remains to significantly lower temperature under applied pressure. Extension of the experiment to higher pressure range is needed to estimate total suppression of the FM phase.

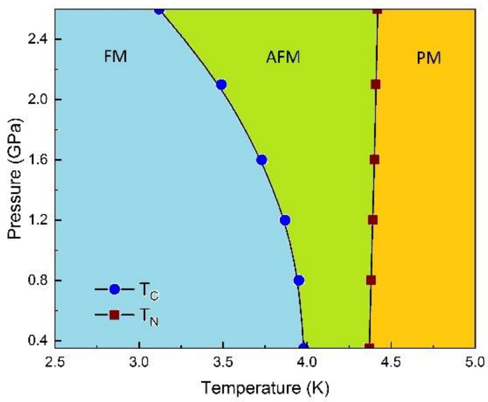

Figure 1. P-T phase diagram of Ce_2Pd_2In. The pressure evolution of Curie temperature T_C and the Néel temperature T_N with coloured areas of ferromagnetic (FM), antiferromagnetic (AFM) and paramagnetic (PM) state of the studied compound. Anomalies estimated from data of both, resisitivity and AC-susceptibility, were used for determination of borders between the particular phases.

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