Phase transition in $CePt_2Al_2$

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The CeT_2X_2 (*T*: transition element, *X*: p-element) intermetallics are intensively studied for their magnetic properties and exotic ground states. Determination of crystal structure is usually the basic characterisation for further research, but this is not the case in $CePt_2Al_2$ and selected homolog compounds, which are structurally unstable at low temperatures. This structural instability influences then the magnetic and electronic properties and plays the key role.

$CePt_2Al_2$ is a new member of this family, therefore we focused on structural properties in broad temperature interval 3 – 500 K. At room temperature the single-crystal X-ray diffraction study shows that the crystal structure is orthorhombic and modulated (*Cmme*(a00)000, with $\vec{q}$= (0.481, 0, 0)). This is uncommon in this family of compounds, which are usually tetragonal at room temperature. The high temperature X-ray powder diffraction was used for structure determination above room temperature and reveals structural transition to a tetragonal structure, which could be presumably described by $CaBe_2Ge_2$ structural type. This transition exhibits 50 K hysteresis and creates a domain structure in the sample. During the transition both tetragonal and orthorhombic phases coexist and their ratio is dependent on cooling rate.

The structural phase transition study is complemented by measurement of physical properties such as a specific heat, magnetization, and transport measurements in the temperature range between 0.5 and 300 K. Specific heat and magnetic susceptibility show an antiferromagnetic order below 2 K. On the basis of electrical resistivity and other bulk measurements, $CePt_2Al_2$ can be considered as a Kondo lattice material, for which the reduction of free magnetic Ce^{3+} moment is typical. The presence of a modulated crystal structure opens the possibility of a charge density wave state in $CePt_2Al_2$ as observed in $(Re)Pt_2Si_2$.

Keywords: structural phase transition, Kondo lattice, CePt2Al2, X-ray powder diffraction, modulated structure

The financial support by ERDF (project 'NanoCent' No. CZ.02.1.01/0.0/0.0/15 003/0000485) is gratefully acknowledged.