ENERGY LEVEL INTERACTION AND MAGNETOCALORIC EFFECT AT ULTRAHIGH PULSED FIELDS IN RARE EARTH ZIRCONS

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9.7 cm

Crossings of the energy levels of magnetic ions in a field give rise to jumps in magnetization of the compound at low temperatures. A character of magnetic anomalies and magnetocaloric effect at pulsed fields depends on the nature of the energy level interaction. Peaks of differential susceptibility dM/dH are observed in tetragonal paramagnets with the zircon structure at 4.2 K in a pulsed field along the tetragonal axis, produced by an explosive method. In $YbPO_4$ a complicated character of interaction of the levels of the crystal-field-split ground multiplet results in a large width of the maximum of dM/dH at H_C=280 T, in adiabatic regime the sample temperature is a nonmonotonic function of the field for $H < H_C$ and does not decrease to the initial one near H_C. In $PrVO_4$ a crossing of two lowest levels leads to a sharp maximum of dM/dH at H_C=50 T and cooling of a sample well below 1 K when a field increases up to H_C. Spectroscopic calculations with regard to the intra-configuration and hyperfine couplings and consideration of the nuclear specific heat plus to the lattice and electronic ones were found to be necessary for an adequate analysis of the magnetocaloric effect in $PrVO_4$ in view of the symmetry of the crossing levels.

13.4 cm

Subject category :

4. Rare Earths and Actinides, Alloys and Compounds

Presentation mode :
poster

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