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Revised Measurements and Interpretation of Magnetic Properties of Oriented CeF₃ Single Crystals

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Abstract

© 2016, Springer Science+Business Media New York. We report the magnetic susceptibility and magnetization of the single-crystal CeF₃ precisely measured in external magnetic field-directed $B \parallel c$ and $B \perp c$ in wide ranges of temperatures from 1.8 to 300 K and magnetic field strength of 0–40 kG. Magnetic susceptibility, magnetization, and Ce³⁺ Stark energies of CeF₃ have been calculated in the framework of the crystal field theory; good agreement with the experimental data has been achieved in the whole range of temperatures and magnetic fields without taking into account the mixed-valent Ce³⁺–Ce⁴⁺ behavior or super-exchange interaction of cerium ions that have been proposed before. Anomalous behavior of the magnetic susceptibility near $T \sim 50$ K is naturally explained in the crystal field model.

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Keywords

CeF₃, Crystal field, Magnetic susceptibility