First Observation of the Spin Ice State in a Spinel Structure

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9.7 cm

Spin ice systems have so far been observed exclusively in pyrochlore systems, $Ho_2Ti_2O_7$ and $Dy_2Ti_2O_7$ being the most studied examples. Spinels, with a general formula AB_2X_4, exhibit a sublattice of octaheadrally coordinated B ions that is identical to the pyrochlore lattice in titanates. We have performed an extensive investigation of the spinel compound $CdEr_2Se_4$ and found a clear signature of the spin ice state. The entropy recovered in magnetic field corresponds to (R/2)ln(3/2) (= entropy of the proton disorder in water ice), the magnetization at low temperature saturates at half of the value of the magnetic moment and the susceptibility drops to zero below the freezing temperature. Due to the different local environment of the erbium ion in the spinel structure, single-ion anisotropy is altered and calculations show that it acquires the needed Ising character. We will compare our results with the pyrochlore compounds.

13.4 cm

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