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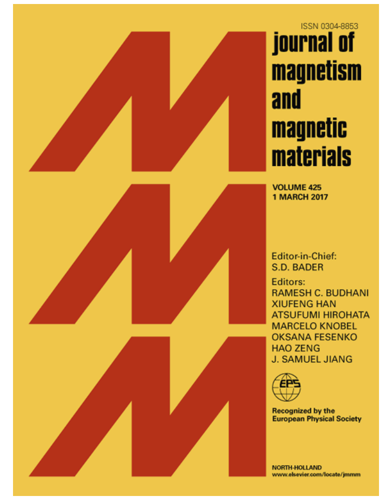

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Magnetostriction of the spin-ice system $Yb_2Ti_2O_7$

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Abstract

Low temperature magnetostriction effects have been studied at $Yb_2Ti_2O_7$ which is characterized by a geometric magnetic frustration. The experimental finding and the developed theory suggest that $Yb_2Ti_2O_7$ is a quantum spin ice. Most of the magnetoelastic effects can be explained by an exchange striction model. The external magnetic field together with the temperature govern the transition between the collective paramagnetic behavior of the classical spin ice and the magnetically ordered state.

Keywords: magnetic frustration, spin ices, magnetostriction
PACS: 75.10.Jm, 75.50.-y, 75.80.+q

1. Introduction

Magnets characterized by Ising spin interactions on a geometrically frustrated lattice are in the scope of interest because the frustration effects result in a variety of ground states, as for example spin-ice, glass-like behavior, order-by-disorder etc., and a non-vanishing zero-point entropy. On the other hand, these magnets are extremely sensitive to weak perturbations as an applied external magnetic field or deviations from the Ising character. These effects can lift the spin degeneracy and drive the system to other phases.

One of the prominent members of the $R_2Ti_2O_7$ series, crystallizing in a pyrochlore lattice (space group $Fd\overline{3}m$) is $Yb_2Ti_2O_7$ which is considered as an example of a quantum spin ice. By the quantum spin ice one usually means rare earth pyrochlore oxides, in which, unlike classical spin ices, the

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