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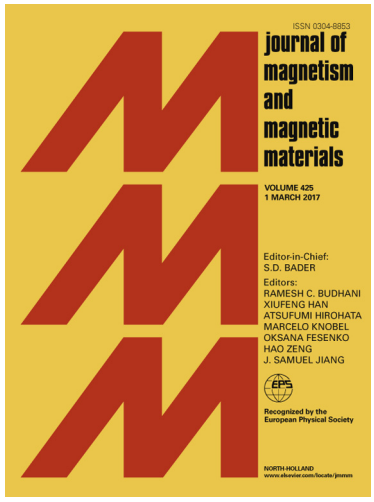

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Thermodynamics of a model solid with magnetoelastic coupling

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Abstract

In the paper a study of a model magnetoelastic solid system is presented. The system of interest is a mean-field magnet with nearest-neighbour ferromagnetic interactions and the underlying s.c. crystalline lattice with the long-range Morse interatomic potential and the anharmonic Debye model for the lattice vibrations. The influence of the external magnetic field on the thermodynamics is investigated, with special emphasis put on the consequences of the magnetoelastic coupling, introduced by the power-law distance dependence of the magnetic exchange integral. Within the fully self-consistent, Gibbs energy-based formalism such thermodynamic quantities as the entropy, the specific heat as well as the lattice and magnetic response functions are calculated and discussed. To complete the picture, the magnetocaloric effect is characterized by analysis of the isothermal entropy change and the adiabatic temperature change in the presence of the external pressure.

Keywords: magnetoelastic coupling, ferromagnetism, thermodynamics of magnets, magnetocaloric effect, entropy, specific heat, thermodynamic response functions, magnetostriction

1. Introduction

The interplay between the magnetic properties and the elastic and structural characteristics of the underlying lattice in magnetic systems and their magnetic properties has attracted considerable attention, including both the theoretical and the experimental approach. The influence of

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