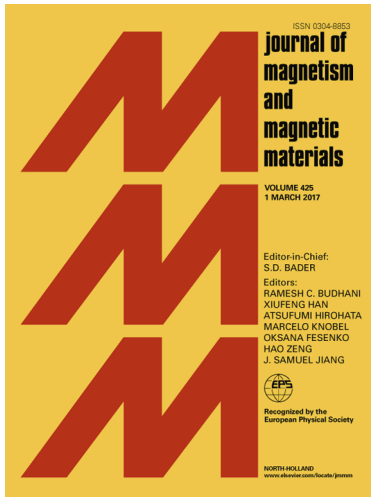

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Spatial resonance in ferromagnetics

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Abstract

Phenomenological Landau theory is used to study an interaction between structural and magnetic subsystems in a crystal in the vicinity of phase-transition lines. It is demonstrated that the twist-induced severe plastic deformation results in a forced onset of inhomogeneous distribution in the magnetic subsystem. A nonsinusoidal spatial modulation of magnetic and structural order parameter moduli is found to arise near the lines of magnetic or structural phase transition. The obtained results permit to construct various distributions of ferromagnetic vector in crystals under twist-induced severe plastic deformation.

Keywords: twist-induced severe plastic deformations, ferromagnetic, order parameter, spatial oscillation, phase transition, harmonics

1. Introduction

An interaction between two or more order parameters (OP) presents a substantial interest since the knowledge of corresponding mechanisms permits to control the behavior of one of the OPs by changing the others. A classical example of this is magnetostriction. An inverse effect is also of substantial interest, when the structural OP determines the behavior of the magnetic one. A systematic study of such effects was commenced in [1], where the phenomenological Landau theory was applied to interaction between two OPs. The corresponding phase diagrams were plotted in a space of coefficients of non-equilibrium thermodynamic potential (NTDP). This approach was further developed in [2]. The majority of succeeding works was carried out within the approximation of OPs of constant moduli, which is valid at a sufficient distance from the line of phase transition (PT). It was demonstrated in [3] that in the vicinity of PT line one must account for the change of OP modulus. The change of moduli of magnetic OP in the spiral crystalline phase results in a forced transformation of the structural OP [4]. When applying

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