物理工学談話会

日時:2023年7月25日 (火) 16:15ー17:15

場所:基礎工学棟 203(ハイブリッドを予定)

講師: Dr. Anna Kosogor

Institute of Magnetism NASU and MESU, Kyiv 03142, Ukraine

題目:“Landau-Type Theory for Multiferroic Phase Transitions: Quantitative Description of Physical Effects”

ミーティングID: 950 3749 9086
パスコード: 607810

どなたでもいらしてください。

世話人: 物理工学・一柳 (内線4185)

Abstract

Multiferroic materials are characterized by the coexistence of multiple ferroic orders, such as ferromagnetism, ferroelectricity, and ferroelasticity, which can undergo phase transitions that lead to significant changes in their functional properties. Landau theory is an effective and well approved tool for the description of physical phenomena accompanying different phase transitions. The special version of Landau-type theory was developed for the quantitative description of physical effects accompanying the magnetoelastic phase transitions in multiferroic materials [1-4]. These transitions involve changes in both the magnetic and structural properties of materials, as so the theory includes magnetic and elastic subsystems and its interrelation. In particular, this approach allows to describe:

1) giant anhysteretic deformation of martensitic alloys in post-critical regime and the conditions of its observation [1];

2) inverse magnetocaloric effect in the Fe-Rh alloy, which undergoes the isostructural ferromagnetic-antiferromagnetic phase transition [2];

3) conventional and inverse magnetocaloric effects in Heusler alloys [3, 4];

4) influence of nanoparticles formation on superelastic behavior of shape memory alloys [5].

The Landau-type phenomenological approach serves as a bridge between macroscopic observations and microscopic models, offering a framework to describe complex phenomena. By facilitating the theoretical comprehension of phase transitions, this approach plays an important role in the design and development of novel materials with target properties.

References:

- [1] A. Kosogor, V.A. L’vov, V.A. Chernenko, E. Villa, J.M. Barandiaran, T. Fukuda, T. Terai, T. Kakeshita, Acta Mat. 66, 79 (2014).
- [2] V.A. L'vov and A. Kosogor, J. Magn. Magn. Mater. 517, 167269 (2021).
- [3] V.A. L'vov, A. Kosogor, J.M. Barandiaran, V.A. Chernenko, J. Appl. Phys. 119, 013902 (2016).
- [4] A. Kosogor, V.A. L’vov, P. Lázpita, C. Seguí, E. Cesari. Metals, 9, 11 (2018).
- [5] V.A. L'vov, A. Kosogor, S. Palamarchuk, G. Gerstein, H.J. Maier. Mater. Sci. Engin. A, 776, 139025 (2020).