講演概要 1:***
Fundamental aspects of ferromagnetic shape memory effect

by Prof. Vladimir Chernenko

The ferromagnetic shape memory effect (FSME) appears as a magnetic field-induced twinning/detwinning in the martensitic phase, resulting in the recoverable strain of the order of martensitic spontaneous distortion. The underlying physics as well as necessary and sufficient conditions of the effect are overviewed. A magnetostrictive mechanism of the giant magnetomechanical response observed in the Ni–Mn–Ga alloys is substantiated within phenomenological theory of ferromagnetic martensites. Alongside the phenomenological aspect of the FSME, the key role of lattice dynamics and electronic states in lattice instability are discussed. The fundamental aspect is illustrated by the experimental results related to the lattice, mechanical and magnetic instabilities in the prototype Ni-Mn-Ga alloys. The phenomena of the magnetoplasticity, magnetic field-induced superelasticity and strong linear dependence of the magnetization upon the twinning deformation of martensite will be reviewed.
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講演概要 2:***
INFLUENCE OF DRIVING MECHANISM ON AVALANCHE CRITICALITY IN FIRST-ORDER PHASE TRANSITIONS

by Prof. Antoni Planes

According to classical equilibrium thermodynamics, extensive variables (S, V, M, ...) are expected to show a significant discontinuity at first-order phase transition which should occur at give values of the corresponding intensive conjugated variables (T, p, H, ...). In real materials, however, these transitions rarely show such a simple behaviour. The expected sharp change of the order parameter is smoothed out and, therefore, the transition spreads over a certain range of the external field. Moreover, it often occurs through a sequence of small discontinuities or avalanches which are a consequence of some kind of interplay between disorder and transition variables. This behaviour has been observed in many different systems and particularly in ferroic and multiferroic materials. The interesting result is that usually the distribution of sizes and duration of the avalanches is power law which proves the absence of characteristic scales of size and time in the dynamics of this class of systems. This is the so-called avalanche criticality.

In my talk I will discuss the effect of driving mechanism on avalanche criticality in the particular case of martensitic transitions. I will present results corresponding to soft- (elongation-controlled) and hard-driving (force-controlled) experiments in a Cu-Zn-Al single crystal. Avalanches have been detected by detecting the acoustic emission during the transition. Obtained results provide experimental support for a recent theory by Pérez-Reche, Truskinovsky and Zanzotto [Phys. Rev. Lett. 101, 230601 (2008)] that predicts a cross-over from classical (requiring fine tuning of disorder) in the soft-driving case to self-organized criticality (nearly independent of the amount of disorder) in the hard-driving case.
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