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U. Hartmann
TWO-DIMENSIONAL SYMMETRICAL BLOCH-TYPE BOUNDARIES IN THIN FILMS

The two-dimensional structure of 180° Bloch walls in uniaxial and cubic thin ferromagnetic films is evaluated by an approximate analytic solution of the constitutive micromagnetic equations under symmetrical boundary conditions. The resulting magnetization configuration exhibits a more or less pronounced surface flux closure by symmetrical contraction depending upon the actual film thickness. The corresponding value of the total energy per unit wall area as a function of film thickness is compared to earlier one- and two-dimensional treatments.

Phys. Stat. Sol. (a) ***101****, 227 (1987)*

U. Hartmann
NEEL REGIONS IN 180° BLOCH WALLS

High-resolution Bitter patterns of subdivided 180° Bloch walls on iron whiskers show an irregular arrangement of substructures with a reduced stray field. The three-dimensional configuration of these Néel regions is derived by an analytic solution of the constitutive micromagnetic equations. The energy with respect to the wall increases with increasing distance to the surface of the crystal. This permits an estimation of the equilibrium depth of the Néel regions.

Phys. Rev. B ***36****, 2328 (1987)*

U. Hartmann
PERIODICITY AND SURFACE FLUX CLOSURE OF MULTIPOLAR 180° BLOCH WALLS

The recent calculation of the specific energy associated with Néel singularities in cubic crystals now permits an estimation of the periodicity and self-magnetostatic energy of multipolar 180° Bloch walls. Additionally, it is shown that the slight zigzagging of these walls in the near-surface region of a crystal causes a considerable reduction of the effective free surface charges by an extensive flux closure internal to the crystal.

J. Appl. Phys. ***62****, 621 (1987)*

U. Hartmann
ORIGIN OF BROWN`S COERCIVE PARADOX IN PERFECT FERROMAGNETIC CRYSTALS

It is brought to evidence that Brown's coercive paradox results from the assumption that the shape of the crystal considered is ellipsoidal. The extremely large demagnetizing fields developed near sharp corners of a uniformly magnetized crystal cause the appearance of closure domains which serve as preexisting nuclei of the magnetization reversal process. Thus, the resulting coercive field of the crystal can be lowered by orders of magnitude from the postulated micromagnetic value. A direct experimental verification of this phenomenon is observed on highly perfect single-crystal iron whiskers.

*Phys. Rev. B **36**, 2331 (1987)*

U. Hartmann
IMPROVED MAGNETIC FINE-STRUCTURE ANALYSIS BY SIMULTANEOUS OBSERVATION OF DOMAINS AND WALLS

An optical technique is presented which permits a simultaneous observation of domains and domain boundaries in transparent and opaque magnetic specimens. The Faraday or Kerr contrast combined with Bitter pattern agglomerations yields a maximum information transference for an investigation of magnetic fine structures. Some results obtained for a uniaxial ferrimagnetic film are discussed.

*Appl. Phys. Lett. **51**, 374 (1987)*

U. Hartmann
NUCLEATION-FIELD DISTRIBUTION OF THE BLOCH-WALL POLARIZATION REVERSAL PROCESS

Complex 180° Bloch walls of alternating polarity have been observed by the interference-contrast colloid technique on single-crystal iron whiskers. Under the influence of an external magnetic field these walls exhibit a conversion into a unipolar configuration. Starting from the completely saturated wall the nucleation of a reverse wall segment requires nucleation fields that approach locally the magnetocrystalline anisotropy field of the crystal. The nucleation-field contour along the wall depends critically upon the surface perfection and the presence of dislocations.

*Phys. Rev. B **36**, 3693 (1987)*

U. Hartmann
A THEORETICAL ANALYSIS OF BITTER-PATTERN EVOLUTION

A theoretical analysis of the bitter-pattern evolution has been formulated basing on a non-interacting particle behaviour. The results permit an estimation of the observed optical contrast produced by the microfield distribution of Bloch walls. Additionally, the information transference concerning the wall width or the fine structure of the walls is discussed.

J. Magn. Magn. Mat. ***68****, 298 (1987)*

R. Berthe, U. Hartmann and H.H. Mende
DEPENDENCE OF THE LONGITUDINAL MAGNETORESISTANCE OF IRON WHISKERS ON THE MEASURING CURRENT

The dependence of the longitudinal magnetoresistance of <100> iron whiskers upon the measuring current is investigated at 4.2 K in magnetic fields up to 20 kA/m. The carbon-saturated single crystal whiskers are 30 to 150 μm in diameter with a residual resistance ratio (RRR) of about 300. The shape of the resulting magnetoresistance curves exhibits a strong dependence on the actual measuring current. Previously existing hysteresis effects and resistivity jumps disappear with increasing current in the range from 0 to 1 A.

Appl. Phys. A ***44****, 223 (1987)*

R. Berthe and U. Hartmann
MAGNETIZATION MEASUREMENTS OF CURRENT-FLOWN IRON WHISKERS

The influence of an electric current flowing in the direction of the long crystal axis of <100> iron whiskers upon the magnetic hysteresis curve is investigated. The magnetization curves of the whiskers with rectangular cross sections of 30 to 200 (μm on a side were measured inductively and compared to the actual domain structure modified by the self-magnetic field of the current. A simple model permits the explanation of the current-induced changes of the magnetization curves.

Phys. Stat. Sol. (a) ***103****, 239 (1987)*

U. Hartmann
THE LOCAL DEPOLARIZATION FIELD OF TWO-DIMENSIONAL 180° BLOCH-TYPE BOUNDARIES

The approximate analytic solution of the constitutive micromagnetic equations yields a selfconsistent expression for the inhomogeneous two-dimensional distribution of the depolarization field within 180° Bloch walls. As a consequence of the assumed constraints, the field distribution is symmetric with respect to the central wall plane and depends, apart from the lateral coordinate, critically upon the actual distance to the crystal surface. The derived results permit a check of the phenomenologic Neel approach as well as a closer discussion of the recently observed wall polarization-reversal process.

Phys. Stat. Sol. (a) ***103****, 247 (1987)*

R. Berthe, A. Birkner and U. Hartmann
CURRENT-INDUCED-CHANGES OF THE MAGNETIC DOMAIN STRUCTURE OF IRON WHISKERS

Using the electronmicroscopic type II magnetic contrast the behavior of the Landau domain structure under the influence of an electric current is investigated. The specimens are carbon saturated single crystal <100> iron whiskers with 20 to 200 μm rectangular cross-section and residual resistance ratios (RRR) of about 300. Characteristic changes of the domain structure due to the selfmagnetic field of a current flowing in the direction of the long crystal axis are observed. Additionally, inductive magnetization measurements are performed in order to detect the behavior for a changing, current.

Phys. Stat. Sol. (a) ***103****, 557 (1987)*

U. Hartmann
EXPERIMENTAL INVESTIGATION OF INTERACTIONS BETWEEN BLOCH-WALL SINGULARITIES AND DISLOCATIONS
Europhys. Lett. ***4****, 1079 (1987)*

U. Hartmann
NEEL-LINE MOTION ALONG BLOCH WALLS

The motion of Néel lines along subdivided 180° Bloch walls has been investigated on iron whisker single crystals by indirect optical observation through the influence on Bitter patterns. The field-induced displacement of the lines is dominated by microscopic Barkhausen jumps, where the lines exhibit a striking flexibility along their longitudinal extent. Phenomena such as line fusion, line nucleation, and interactions with crystal defects have been investigated more closely.

J. Appl. Phys. ***62****, 4918 (1987)*