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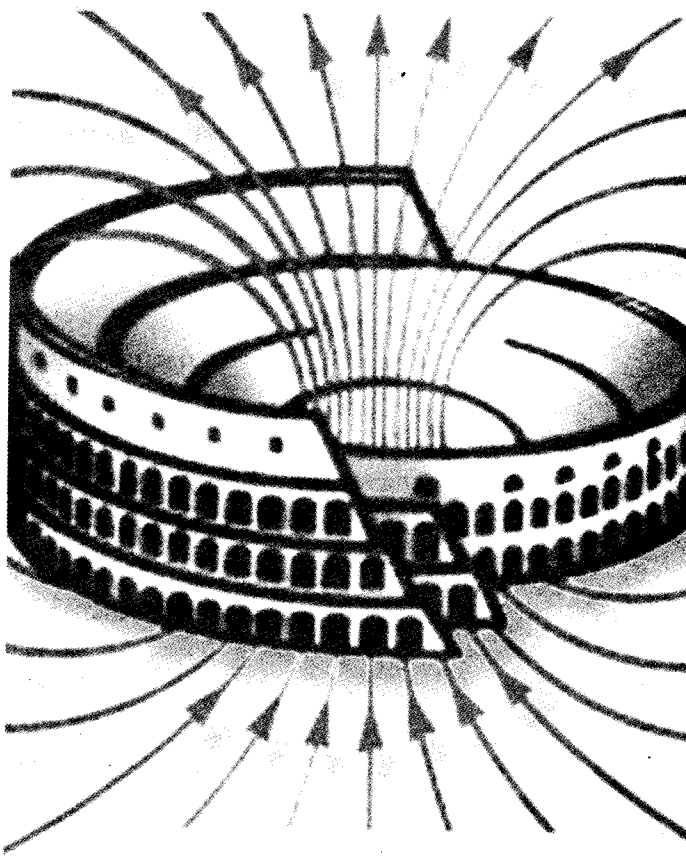

Incorporating

The Symposium on Strongly Correlated Electron Systems

abstracts

1T-pm-35— THE ELASTIC WAVES IN AMORPHOUS RIBBON EXITED BY LOW FREQUENCY LOCAL MAGNETIC FIELD

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The amorphous ribbons with different composition (Fe based and Co based) and length (from 15 to 90 cm) were used for investigation the elastic waves exited by magnetic field due to magnetostriction. The control of vibration the piezoelectric sensor was used. The AC magnetic field with amplitude 5 Oe was applied locally at the distance about 5 cm from the end of ribbon. The glass niddle, connected to the piezoelectric sensor, moved along the ribbon. The voltage of the sensor controlled with osciloscope. It was found that at definite frequencies the amplitude of vibration on the double frequency depended on distance from exiting coil periodically. The sound velocity was calculated for investigated samples.

2V-pm-34— INVESTIGATION OF THE CO PARTICLE SIZE DISTRIBUTION IN ENSEMBLE, PRODUCED BY REDUCTION FROM CO OXIDE.

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The investigation of properties of magnetic nano-size particles materials attracts a lot of attention both from fundamental and application points of view. Information about the particle size distribution helps our understanding of magnetic properties of these systems. In this work we present the way of evaluation of the particle size distribution from data of magnetic measurements. We used Co/SiO_2 samples consisting fine Co particles, produced by chemical method. Co particles were reduced from the Co_3O_4 and partially oxidized inside porous of the silica gel. Samples with various degrees of reduction and oxidation were investigated. We assumed that Co nanoparticles could be divided into two groups. The first group consists of superparamagnetic particles; a behavior of this system in the applied magnetic field can be described by the Langeven function averaged over the particle size distribution. The second group of particles ("large" particles) consists of granules of the larger size having anisotropy, magnetization behavior of this subsystem has a hysteresis when applying the magnetic field. We described small and large particles by the log-normal distribution. Four parameters being included in our model, d_1, σ_1, H_c^0, σ_2, are determined using numerical procedure of minimization of a root-mean-square deviation between a theoretical and experimental loop.

We have measured the hysteresis loops using vibrating sample anisometer-magnetometer. The theoretical loop fits well experimental one, it is a sum of hysteresis loop due to single domain particles and magnetization curve due to superparamagnetic particles. The calculated particle size distributions have two peaks, more or less separated. The first and the second peaks correspond to superpara- and single domain particles, respectively. We have got essentially different kinds of distributions for samples produced with different technological conditions.

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4R-am-08—— STRUCTURAL RELAXATION OF AMORPHOUS METALLIC ALLOYS AT LOW TEMPERATURE

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The thermal cycling produces the irreversible change of magnetic properties of amorphous alloys both for heating and cooling processes [1]. The neutron scattering is very sensitive to investigate short-range change of structure, which could occur during thermal treatment. We present the results of the neutron investigations of the structural relaxation in the amorphous metallic alloy Fe-Ni-Si-B and Fe-Co-Si-B after low temperature treatment (LTT).

The measurements were made before and after samples cooling up to temperature of the liquid nitrogen. It was observed that LTT decreased the coercive force and increased the saturation magnetization both in dynamic and static magnetic measurements. The total structure factor S(Q) and the total pair correlation function g(r) in amorphous metallic alloys were measured by the method of neutron scattering with a time-of-flight diffractometer.

Over the region of ~12Å a change in the atomic structure can be seen. Changes of the atomic density were mainly observed for the interatomic distances of the short-range order. The obtained changes of short-range order are evidently the consequence of amorphous alloy structure transition to the new metastable state due to relaxation of structural defects. A change in the atomic density causes changes of the macroscopic properties (such as magnetization). The correlation between the macroscopic properties changes and short-range order of the amorphous structure after LTT is discussed.

The researches were supported by grants of Russian Fund of Basic Research No 03-02-17164.

[1] Zaichenko S.G. et al. Doclady Physics, 44 (8) (1999) 545.

4R-am-16—— CALCULATION OF QUENCHING STRESS LEVEL IN AMORPHOUS ALLOY RIBBONS FROM THE DATA ON MAGNETIC STRUCTURE

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It is known that so called "islet" domains are one of the most important elements of magnetic structure of amorphous metallic alloys (AMAs). These domains are perpendicular to AMA ribbon's surface and disappear only when the magnitude of an external magnetic field applied parallel to ribbon axis reaches the value of the saturation magnetisation. One can observe bowing 180-degree domain walls surrounding thin zigzag domain groups.

For the first time we have developed the algorithm for internal stress calculations from the data on 'islet" domain structure. Functional connections between the temperature dependence of the saturation magnetisation and spin-wave stiffness constant, on the one hand, and between the exchange interaction constant and the magnetic anisotropy energy, on the other hand, are the elements of this algorithm. The mechanism of the "islet" domain formation is discussed.

Proposed approach can be used for achievement of the optimal magnetic characteristics of AMAs due to the full relaxation of the internal stresses.

The research was supported by grant of Russian Fund of Basic Research No 03-02-17164.

4T-am-06—— THE PECULIARITY OF STATIC AND DYNAMIC PROPERTIES OF IRON FILMS

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We investigated the static and dynamic magnetic properties of the iron films, prepared by magnetron sputtering of Iron in Ar atmosphere at pressure 10^{-4} Torr on mylar substrate. For changing the condition of sputtering the partial pressure of nitrogen was varied from 0.1% till 5 %. The film thickness changed from 0.1 to 1 mkm. The atomic force microscopy for all samples showed that the grain size increased while the film thickness increased.

To measure the permeability in the frequency range of 100 MHz to 10 GHz the coaxial technique was used. The technique implies winding a film into a hollow cylindrical sample that fits the section of a standard coaxial measuring cell.

The microscopic structure of Fe films, which determines the magnetic properties, depends on manufacturing process. And we found a variety of types of permeability dispersion curves exhibited by Fe films. Both the location and the width of the magnetic absorption curves are shown to be highly adjustable by certain technological means. The amplitude of spectra is related to its location. In the most of studied films the magnetic spectra are complex and show two lorentzian components. The amplitudes of these do not attain the limiting value established in [1].

The maximum of permeability was found in films with thickness about 0.1 mkm. The same samples had the smallest value of coercivity. The magnetic anisotropy is shown to increase with the sample thickness.

[1] O. Acher and A.L. Adenot. Phys.Rev. B, 62 (2000) 11324.

5S-pm-06—— MAGNETIZATION REVERSAL IN Co-BASED AMORPHOUS MICROWIRES INDUCED BY LONGITUDINAL AC MAGNETIC FIELD.

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The frequency spectra of magnetization reversal process in CoFeSiB amorphous microwires in AC longitudinal magnetic field are studied. The wires produced by UNITIKA were 30 μm in diameter. The samples of length 6.6 mm were placed into the solenoid oriented along the wire axis. The harmonic amplitudes of the voltage at the wire ends were measured by a spectrum analyzer HP4395A as a function of the AC magnetic field amplitude (up to 25 Oe), its frequency varying between 0.5 to 2 MHz, and the value of applied longitudinal DC magnetic field.

The first harmonic dominates in the frequency spectrum at low AC magnetic field amplitudes. At higher AC field, several harmonics are of the same order of magnitude. The harmonic amplitudes are nonhysteretic and symmetric with respect to the sign of the longitudinal DC magnetic field. The behavior of the amplitudes of odd and even harmonics differs significantly. For instance, when DC magnetic field is not applied even harmonics are lacking whereas the odd harmonic amplitudes reach maximum values. The dependences of harmonic amplitudes on the DC magnetic field exhibit several peaks. The value of the DC field, at which the peak takes place, increases linearly with the AC field amplitude.

The harmonic amplitudes are very sensitive to the longitudinal DC magnetic field. The magnetic field sensitivity for the first and second harmonic amplitudes is of the order of 1 V/Oe at frequency 1 MHz. The obtained results are interpreted in the framework of a simple model based on Landau-Lifshitz and Maxwell equations taking into account a non-uniform distribution of the magnetization over the wire cross-section as well as over its length. Possible applications of the observed high sensitive to magnetic field nonlinear effect are discussed.

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5W-pm-30— INVESTIGATIONS OF THE MAGNETIC FIELD EFFECT ON ELECTROCHEMICAL PROCESSES

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The investigations of the electrochemical processes Faraday started more than 150 years ago. The magnetic field effect in this phenomena was found a little more than 100 years ago. A. Gross (1885), R. Andrews (1887-1890), T. Rowland (1888-1893), R. Paillot (1900-1902) and others investigated the change of the electrode potential of different materials in magnetic field. No explanation of this dependence was suggested, may be, because of low reproducibility of the results

Some years ago the new investigations of this effect were started. The results, which some groups [1,2] have got, were similar only in case of iron electrodes. The electrodes made from the other materials gave non-reproducible results usually (in different groups).

We considered a next possible origin of the electrode potential change with magnetic field: the interaction of the electrolyte with a magnetized surface; the interaction of the gradient magnetic field with ions; the interaction of the magnetic field with moving ions (Lorenz force); and the change of the iron chemical potential in the magnetic field.

The corresponding experiments and their results are discussed.

[1] Waskaas M. Acta chemica Scandinavica 50 (1996) 516-520.
[2] Hinds et al. IEEE Transaction on Magnetics 38 (5) (2002) 3216–3218.