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Low Temperature Dependence of HF-Magnetic Properties of Soft Nanostructured Films.

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The strong dependence of magnetic properties of finemet and permalloy from their structure and composition is known. These materials are applied widely for creation of micro magnetic sensor on GMI (giant magneto-impedance) and GMR (giant magneto-resistance) effects for measuring magnetic fields, and of systems for recording and storage of information. Since these materials are used widely in integrated microelectronic devices, high stability and reproducibility of their properties are required. On the other hand, the production of these materials in soft magnetic state is connected with a presence of amorphous or nanocrystalline structure, which may be metastable. On the basis of the developed by us technology of creation of thin magnetic low-coercivity (~ 0,1 Oe) films, the dependence of their magnetostatic and magneto-impedance properties on temperature was studied. Their morphology and structure was simultaneously investigated by transmission electron microscopy (TEM), atomic force microscopy (AFM), magnetic force microscopy (MFM) and X-ray diffraction methods. Low-coercivity films were produced by ion-beam sputtering magnetic alloys. It is shown that at change of annealing temperature in a range from 100°C up to 600°C (also for Joule heating) the most significant changes of magnetic properties occur at temperatures much below than Curie temperature. Thus magnetostatic and magneto-impedance characteristics reach a maximum in an interval of temperatures, at which actually is not observed changes of crystal structure. The similar dependencies were observed earlier in the literature at temperatures higher 100°? -200°? . The observed effects can be explained from the point of view of dynamics of point defects during formation of grain boundaries and pores at the nanodimensional level. The offered mechanism is confirmed by more careful analysis of results of microscopic researches [1,2].

References

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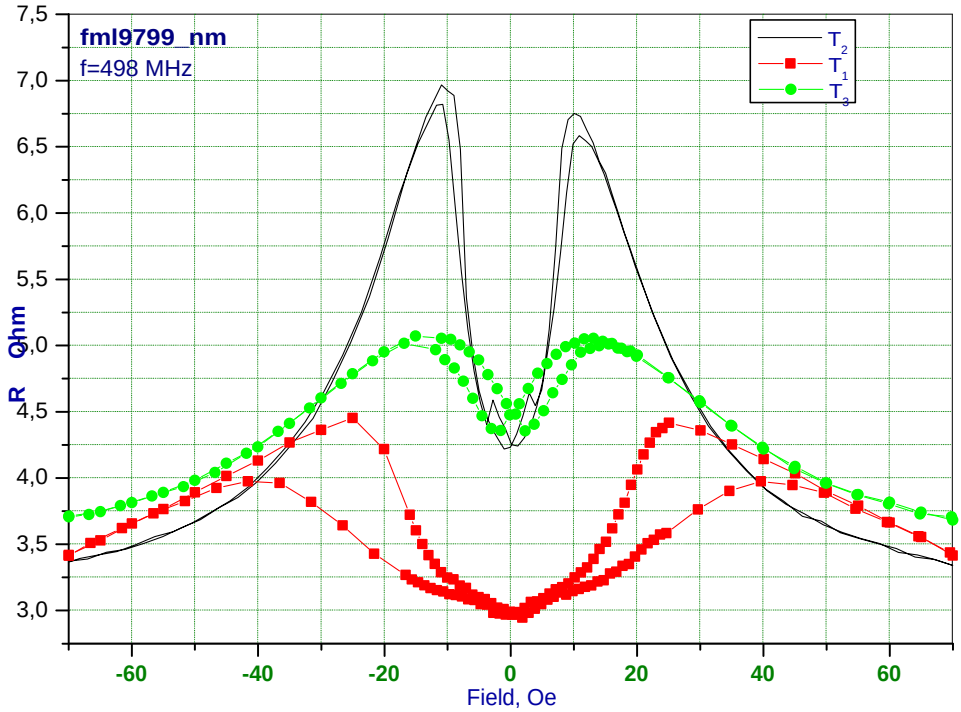

FIG. 1 The dependence real part of the impedance – magnetic field, under different annealing temperature ($T_1<T_2<T_3$).

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