

The Effect of Mechanical Stress on the Magnetic Structure and Properties of Ferromagnetic Microwires in Glass Insulation

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Abstract : We have investigated the change of the magnetic structure and the hysteresis properties of iron-based microwires after decreasing levels of internal mechanical stresses. The magnetic structure was investigated by the method of magneto-optical indicator film and the method of magnetic force microscopy. The hysteresis properties were studied by the vibrating sample magnetometer. The stresses were decreased by removing the glass coat and/or by low-temperature isothermal annealing. Previously, the authors carried out experimentally investigation of the magnetic structure of Fe-based microwire using these methods. According to the obtained results the domain structure of a microwire with a positive magnetostriction is composed of the inner cylindrical domains with the magnetization along the wire axis and the surface layer of the ring shape domains with the radial direction of magnetization. Surface ring domains with opposite magnetization direction (i.e., to the axis or from the axis) alternate with each other. For the first time the size of magnetic domains was determined experimentally. In this study it was found that in the iron-based microwires the value of the coercive force can be reduce more than twice by decreasing levels of internal mechanical stresses. Decrease of the internal stress value by the relaxation annealing influence on the magnetic structure. So in the as-prepared microwires observed local deviations of the magnetization of the magnetic core domains from the axis of the wire. After low-temperature annealing the local deviations of magnetization is not observed.

Keywords : amorphous microwire, magnetic structure, internal stress, hysteresis properties, ferromagnetic

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