

Abstract ID-022

DESIGN OF MAGNETIC PROPERTIES OF GLASS-COATED MICROWIRES FOR MAGNETIC SENSORS APPLICATIONS¹Arcady Zhukov, ²Mihail Ipatov, ²Ahmed Talaat, ²Valentina Zhukova

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Keywords: Glass-Coated Microwires, Soft Magnets, Internal Stresses

Summary: Extremely soft magnetic properties and Giant Magnetoimpedance effect are the features of magnetic wires that have been proposed for already existing and proposed industrial applications. Miniaturization of magnetic sensors requires reduction of the magnetic wires diameters[1]. Thinnest magnetic wires can be produced using Taylor-Ulitovsky method allowing preparation of glass-coated microwires with metallic nucleus diameters from 0.05 to 50 μm coated by glass with thickness ranging from 0.5 up to 30 μm . Fabrication method essentially consists of the melting of the metallic alloy ingot inside the glass tube and rapid quenching from the melt of the metallic nucleus completely coated by a glass [2]. Therefore studies of magnetically soft glass-coated microwires attracted great attention along the last few years [1,2].

The proven advantage of the Taylor-Ulitovsky technique allowing preparation of composite microwires is that the obtained metallic nucleus diameter could be significantly reduced as compared with the case of amorphous wires produced by other methods: the diameter of the metallic nucleus can be varied from 200 nm to 50 μm [2]. Magnetic softness of amorphous microwires depends on the composition of the metallic nucleus, as well as on the composition and thickness of the glass coating [2]. Moreover the magnetic softness of amorphous microwires depend on the composition of the metallic nucleus, as well as on the composition and thickness of the glass coating layer[2].

Consequently we present studies of effect of annealing on Giant magnetoimpedance (GMI) effect and magnetic properties of amorphous Fe and Co- rich microwires for optimization of magnetic softness of this material. High GMI effect has been observed in as-prepared and annealed at certain conditions Co-rich microwires. We observed that changing the annealing conditions we can obtain a great variety of properties in Co-rich microwire. High domain wall (DW) velocity and rectangular hysteresis loops we observed in heat treated Co-rich microwires and as-prepared Fe-rich microwires. Performed studies allow to design magnetic properties of microwires for sensor applications.