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INFLUENCE OF THE INHOMOGENEITIES ON MAGNETIC PROPERTIES OF GLASS-COATED MICROWIRES

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Summary: Studies of magnetic properties and giant magneto-impedance, GMI, of amorphous and nanocrystalline glass-coated microwires attracted considerable interest owing to emerging applications in magnetic field sensors, magnetic memories and logics [1]. In the absence of defects typical for crystalline magnetic materials (dislocations, grain boundaries…), the magnetoelastic anisotropy minimization is essentially important for the optimization of magnetic properties of amorphous microwires. This magnetoelastic anisotropy originates mostly from the different thermal expansion coefficients of metallic nucleus and glass coating during rapid solidification of the composite microwires. On the other hand recently has been reported that some magnetic properties, like domain walls (DW) velocity are limited not only by the magnetoelastic anisotropy but also by local defects responsible for the multiple DW nucleation in different places of the microwire [1]. The origin of these defects in ferromagnetic amorphous microwires is still unclear. Previously the existence of the intrinsic defects related to the proper technological procedure of glass-coated microwires fabrication has been studied only for non-magnetic microwires. Recently we observed the defects in amorphous microwires [1].

Consequently we present studies of the inhomogeneities and interfacial layer between the metallic nucleus and glass coating of Fe-Co rich glass-coated microwires with ferromagnetic metallic nucleus. We used optical microscope Axio Scope A1 for studies of metallic nucleus and glass coating inhomogeneities and scanning electron microscope JEOL JSM-6610 for studies of the interfacial layer between the metallic nucleus and glass-coating.

We observed gas bubbles within the glass coating with volume content of about 9-12 %. The sizes of the bubbles were between 1 and 15 mkm. The existence of such bubbles might be the origin of the inhomogeneities in the internal stresses distribution.

We obtained the image of the interfacial layer and the elements distribution within the glass coating and metallic nucleus. This allowed us to estimate the thickness of the interfacial layer.

Understanding of the origins of the interfacial layer and defects may help for improvement of the existing technology for thin composite wires fabrication and enhance their magnetic properties.