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Comprehensive study of structure and magnetic characteristics of FeNi nanotubes with different lengths

Promising materials to create magnetic nanostructures for wide range applications from biomedicine to elements of electronic devices is iron and nickel alloys (permalloy as well) due to its high saturation magnetization and low coercivity in comparison with the value for pure ferromagnetic metals as Ni and Fe. In this work FeNi nanotubes with diameters of 380 nm, wall thickness of 110 nm were synthesized by template synthesis method in the pores of PET templates. To determine of template synthesis method limitations nanotubes with different lengths (from 3 to 12 μm). A comprehensive study of their structure and magnetic characteristics was carried out. It was shown that an increase in nanotubes length leads to an increase in crystallinity degree, as well as a decrease in lattice parameter and structure microdeformation. The change of structural parameters is closely related to stages of nanotubes electrodeposition: from the initial defect structure with the smallest crystallinity degree, with short nanotubes length to the final one, with practical achievement of total length of the pore having a polycrystalline low-defect structure. Based on magnetic characteristics study of the presence of magnetic anisotropy in FeNi nanotubes was shown, as well as nonlinear character of its dependence on the length. The contribution of such factors as crystal structure as well as nanotubes length greatly affects on magnetic properties. Nanotubes with predictable structural and magnetic properties can be obtained with lengths from 3 μm by electrodeposition method.

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