"Nanocomposites and nanomaterials"

Magnetic and electrical properties of Fe-B-P-Nb-Cr nanocrystalline alloys

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The magnetic properties of amorphous Fe-B-P-Nb-Cr alloys, obtained by melt spinning technique, after their nanocrystallization were investigated. By optimizing the chemical composition and heat treatment conditions selection, high values of saturation induction B_S=1,37 T, initial permeability μ_{10}=7800 units, low values of dynamic coercivity H_C=3 A/m with low core loss $P_{10/1000}$~5 W/kg were reached.

From the study of the temperature dependences of the electrical resistance in the range of 77-846 K follows that the temperature coefficient α_{300} for all investigated alloys is less than 10^{-4} K^{-1} and the values of the resistivity ρ_{300} are in range 170-190 μΩ·cm. The values of α_{300} are lower and the values of ρ_{300} are quite higher in comparison with typical values for most amorphous Fe-based alloys (greater than 10^{-4} K^{-1} and 100-150 μΩ·cm respectively). The high values of ρ_{300} and the low values of α_{300} along with good magnetic parameters are additional factors that contribute to high operational properties of such materials as magnetic elements for various purposes.

According to the analysis of small-angle X-ray scattering spectra, size distribution of inhomogeneities that are nanocrystalline groups was defined [1]. The lower size limit of such inhomogeneities estimated by the half-width of structural factor [2] correlates with the results of small-angle scattering.

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