Partial crystallized state of amorphous $Fe_{81-x}Ni_xZr_7B_{12}$, x=10-60 alloys

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A series of amorphous melt-spun ribbons of NANOPERM-type [1] $Fe_{81-x}Ni_xZr_7B_{12}$ (x=10, 20, 30, 40, 50, 60) alloys has been studied by means of X-ray diffractometry (XRD), differential scanning calorimetry (DSC), electrical resistivity (dc four-probe method) and thermomagnetic measurements. The thermal stability characteristics (the glass transition and crystallization temperatures, heats and apparent activation energies of transformation) of the amorphous alloys have non-monotonic dependencies on the Ni content. The apparent activation energy of crystallization correlates with the thermal stability of the glassy structure. Magnetic properties of amorphous samples are similar to those of conventional crystalline FeNi alloys as well as for commercial $Fe_{80-x}Ni_xP_{14}B_6$ glasses. As expected, the magnetic moment decreases with Ni addition, while the Curie temperature has a maximum around x=40 [2, 3]. The crystallization mode at a constant rate heating of the glasses studied depends on the Ni content [3, 4]. The glasses with a low Ni content (x=10-30 at. %) at the first transformation stage crystallize into bcc-FeNi solid solution, while the first crystalline precipitates in the glasses with x=40-60 have fcc structure (austenite). Structural parameters (the sizes of the nanocrystals and their volume densities) of the partially crystallized samples are close to those found in the FINEMET, NANOPERM and HITPERM alloys with similar nanostructure [1, 5].

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