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# SOFT MAGNETIC CO-BASED AMORPHOUS ALLOYS WITH HIGH HYSTERESIS LOOP LINEARITY AND HIGH SATURATION INDUCTION

Amorphous alloys of two systems of $Co_{72.5–73.0}(Fe,Ni,Mn,Mo)_{4.8–5.8}(Si_{0.21–0.24}B_{0.79–0.76})_{21–22}$ and $Co_{55.7–58.3}(Fe,Ni,Mn)_{21.6–24.2}(Si_{0.2}B_{0.8})_{20.1}$ with high saturation induction ($B_s \geq 0.9$ T) were developed. When studying thermal stability and magnetic characteristics of toroidal magnetic cores made of these alloys, it was found that onset temperature of primary crystallization $T_{\text{ons1}}$ depends on the chemical composition of the alloy and decreases when total nickel, iron and manganese content in the alloy increases.

Induction of transverse magnetic anisotropy in the course of heat-magnetic treatment (HMT) becomes easier at complex Ni, Mn and Mo doping of alloys that is accompanied by noticeable Curie temperature decrease and results in reduction of the effective magnetic permeability and higher field stability combined with low coercive force $H_c$.

Thermal stability levels of promising amorphous metal alloys (AMA) corresponding to onset of destruction of magnetic anisotropy induced by transverse field were established.

For the most promising alloy compositions, the value of effective magnetic permeability decreases compared to known alloys down to 550–670 units and remains constant in the wide magnetic field strength range of 1100–1300 A/m. The maximum remagnetization loop linearity is achieved after the optimum HMT in AMAs with high Ni content, which are characterized by low squareness ratio values $K_{\text{sq}} = 0.002–0.02$ and $H_c = 1.0$ A/m.

**Keywords:** amorphous alloy, crystallization temperature, Curie temperature, thermomagnetic treatment, magnetic permeability, coercive force, saturation induction

**Fig. 1.** Temperature dependence of reduced effective magnetic permeability for as-cast alloys: ▲ – alloy № 1, ○ – 2, ▼ – 3, ◇ – 4, ■ – 5; $f = 10$ kHz, $H = 1$ A/m, $V_{\text{heat}} = 5.7$ K/min

**Fig. 2**. Temperature dependence of reduced effective magnetic permeability for alloy № 4 in as-cast state (◇) and after preliminary heat-magnetic treatment at 600 K for 1 h (◆); $f = 10$ kHz, $H = 1$ A/m, $V_{\text{heat}} = 5.7$ K/min

**Fig. 3.** Magnetic field dependence of induction (*a*) and effective magnetic permeability (*б*) after optimum heat treatment of the alloys: ▲ – alloy № 1, ○ – 2, ▼ – 3, ◇ – 4, ■ – 5; $f = 1$ kHz