

**PHYSICAL PROPERTIES OF Fe-Ni-B-Si-Nb ALLOYS
IN CRYSTALLINE, LIQUID AND AMORPHOUS STATES**

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Bulk metallic glasses (BMG) are the objects with unique magnetic, mechanical, and anticorrosive properties. They significantly exceed crystalline analogues and can be used in chemically aggressive environments and in difficult climatic conditions. For example, iron-based metallic glasses have excellent soft magnetic characteristics (the saturation induction reaches $B_{\max} = 1$ T at a coercive force $H_c = 1$ A/m; for the same alloys in crystalline state $B_{\max} = 0.2$ T at $H_c > 100$ A/m). In addition, these BMGs are characterized by ultra-high values of fracture resistance at the level of 4250-4450 MPa and plastic deformation of 0.6-1.3% (for crystalline analogs, these parameters are 4-5 times lower). However, the widespread use of BMG is limited by the instability of the amorphous state, which can crystallize under certain external influences.

In this paper we studied temperature dependences of physical properties (density, viscosity, electrical resistivity and magnetic susceptibility) of Fe-Ni-B-Si-Nb alloys, and investigated the influence of chemical composition and regimes of melts preparation for quenching on properties and stability of the alloys in amorphous state. Some parameters of electronic structure of the alloy were calculated from the experimental data: the effective magnetic moment per atom μ_{eff} , the paramagnetic Curie temperature θ and the density of electron states at Fermi level $N(E_F)$.

The combination of the obtained data on volumetric (density and viscosity) and electronic (electrical resistivity and magnetic susceptibility) characteristics, as well as the discovered temperature ranges in which anomalies in density and electrical resistivity curves for iron-based melts were observed, became the basis for the creation of several regimes for melts heat treatment before amorphization. It was established, in particular, that crystallization occurs in one or two stages depending on chemical composition of the sample. The decreasing of nickel content in the samples increases both the crystallization onset temperature and the peak temperature of the second stage. An increase in boron content has a similar effect, i.e. the most stable amorphous state was in the sample containing 20 at.% boron. However, this sample has the lowest Curie temperature.

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