CRYSTALLIZATION BEHAVIOR OF Fe-Ni-B-Nb AND Fe-Ni-B-Si-Nb AMORPHOUS ALLOYS WITH DIFFERENT COMPONENT RATIOS

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Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys in a disordered condensed state (in the form of amorphous ribbons and bulk amorphous rods) have been actively studied in recent years due to their unique electrical and magnetic properties. Such alloys in an amorphous state are beginning to be used as promising materials in industry. In this work, the crystallization of amorphous Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys with different component contents is investigated for the first time.

Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys were obtained in the form of ribbons with a width of 2-3 mm and a thickness of up to 45 μm by spinning (planar flow casting) method in a protective argon atmosphere. Crystallization processes were studied using differential scanning calorimetry (DSC) at various heating rates and X-ray diffraction.

Based on the results of diffraction experiments with Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb ribbons, it was established that all obtained samples are X-ray amorphous. It has been shown that the crystallization processes of amorphous Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys are multistage (1-3 crystallization stages depending on the alloy composition). Based on the DSC data, the activation energy of the various crystallization stages was calculated using the Kissinger method, and the kinetic parameters and Avrami index were determined using the Kolmogorov-Jones-Mehl-Avrami (KJMA) model in the variant for non-isothermal crystallization. It is shown that after the first stage of crystallization of amorphous Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys, the main phase is the metastable $(Fe,Ni)_{23}B_6$ phase with partial replacement of iron and nickel atoms by niobium atoms.

The obtained results can be used for further research into the physical and chemical properties of amorphous and partially crystallized Fe-Ni-B-Nb and Fe-Ni-B-Si-Nb alloys, as well as for their practical application in industry.

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