

Effect of isothermal and electric-pulse treatment on the structure of Ti50Ni25Cu25 rapid-quenched ribbons with a surface crystal layer

Sitnikov N N^{1,®}, Shelyakov A V² and Zaletova I A¹

¹ State Scientific Centre of the Russian Federation—Keldysh Research Center, Onezhskaya Street 8, Moscow 125438, Russia

² National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe Shosse 31, Moscow 115409, Russia

® sitnikov_nikolay@mail.ru

In the present work, laminated amorphous-crystalline Ti50Ni25Cu25 alloy ribbons with different crystal layer thicknesses were obtained by rapid-quenched technique on a rotating disk at cooling rates of about 100 000 K/s. The amorphous-crystalline ribbons were subjected to heat treatment in a calorimeter, isothermal treatment in a muffle furnace (for 300 s) and electric-pulse treatment with a processing time of 5 s to 1 ms. The processes of formation and growth of the crystalline phase from the amorphous part of the ribbon were studied using differential scanning calorimetry, scanning electron microscopy, and x-ray diffraction analysis. The microstructure of the ribbons after heat treatment in the cross section is characterized by an uneven distribution of crystals over the thickness of the ribbon: large crystals are present in the inner part of the ribbon, and on the contact sides columnar structures are observed. Electric-pulse treatment with an exposure time of less than 1 s leads to a significant change in the formed crystal structure compared to the structure obtained by isothermal treatment. Columnar crystals observed from the contact side ribbon retain their original texture. With a decrease in the time of electric-pulse processing, the proportion of columnar crystals that germinate from the ribbon surfaces to the inner part before their contact increases, and a homogeneous boundary is formed between them. This work is supported by grant No. 19-12-00327 from the Russian Science Foundation.