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ON THE DYNAMICS OF THE CURRENT FLOWING THROUGH A SAMPLE OF ALUMINUM OXIDE CERAMICS WITH TITANIUM DURING ELECTRON BEAM SINTERING

A.A. ZENIN, I.YU. BAKEEV*, A.A. KLIMOV*, E.M. OKS***

** Tomsk State University of Control Systems and Radioelectronics,*
Russia, Tomsk, 40 Lenina ave., 634050
*** Institute of High Current Electronics SB RAS, 2/3 Academichesky Ave., Tomsk, 634055, Russia*

Trends in the development of modern technologies require the development of new and improvement of existing composite materials, both organic and inorganic. One of the promising materials from the point of view of technology are various composites based on a matrix of alumina ceramics [1]. The physical and mechanical properties of finished products depend both on the initial composition of the compacted mixture and on the technology of its further sintering. Plasma electron-beam technologies developed at the TUSUR Department of Physics make it possible to treat conductive and non-conductive materials [2]. One of the areas of work of this research team is the electron-beam sintering of ceramics [3]. This work is devoted to the study of current flow through a sample of alumina ceramics with the addition of 10% titanium.

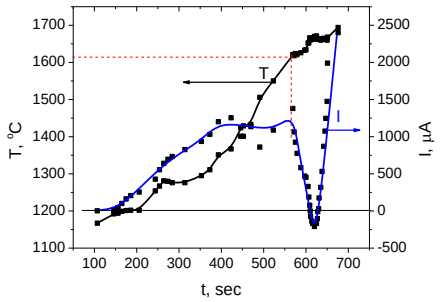

Fig. 1. Dynamics of changes in the flowing current through the sample during electron-beam sintering of aluminum oxide ceramics with titanium depending on temperature

Several characteristic areas can be clearly distinguished from the graph presented in Fig. 1. So, at temperatures of the surface of the sintered sample from 1200 to 1350 ℃, a monotonous increase in the current flowing through the sample is observed, while the current reaches about 1000 μA. With a further increase in the sample temperature in the range of 1400-1630 ℃, the current growth stops. However, when a certain critical temperature value of 1630-1640 ℃ is exceeded, a sharp decrease in current is observed down to a change in polarity, and upon subsequent heating, the current again increases to the previous values and even higher. Such dynamics of the current flow, namely, the observed current drop through the sample, can be explained by the thermionic emission of titanium on the surface of the compact. With the subsequent evaporation of titanium, the current returns to its original values.

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