ABSTRACT

The work contains: 84 p., 21 fig., 8 tabl., 44 refer. Object of research – HfN–HfB_2.

The purpose of this work is to study the process of reactive spark-plasma synthesis of the HfN – HfB_2 alloy.

Methods of samples manufacturing: reactive spark-plasma sintering.

The electrophysical features of spark-plasma sintering (SPS) of HfN – HfB_2 i Hf + BN powder mixtures to produce ceramic composite material based on HfN – HfB_2 are studied and the dependence of its properties on direct-current density at the initial stage of sintering is established. To determine the direct current density, the method for calculating the effective cross-sectional area Seff of “die–sample” subcircuit is proposed. The basic part of electric current passes through the graphite matrix at the initial stage of sintering because of resistances on contacts and presence of α-BN dielectric. The basic part of electric current passes through the sintered sample at the final stage of sintering since HfN – HfB_2 composite is synthesized and densified and, consequently, the conductivity of the sintered sample sharply increases. Higher initial direct-current density during sintering of HfH_x hydride samples leads to increase in relative density and, respectively, conductivity, microhardness, fracture toughness, and abrasive wear resistance.

Keywords: CERAMIC COMPOSITE MATERIAL, ELECTROPHYSICAL PROPERTIES, SPARK PLASMA SINTERING, HfN–HfB_2, POWDER, CERAMICS.