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THE EFFECT OF HEATING ON THE CHARGE NEUTRALIZATION OF Al_2O_3-ZrO_2 CERAMICS DURING ELECTRON BEAM SINTERING IN THE FOREVACUUM PRESSURE RANGE*

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Ceramic composites based on aluminum oxide and zirconium dioxide are used in conditions of high thermal and mechanical loads. The Al_2O_3-based material is highly corrosion resistant, resistant to most organic and inorganic acids and salts. The main disadvantage of this material is low crack resistance in a number of structural ceramics. To eliminate this disadvantage, an additive of zirconium dioxide (ZrO_2) is used, which has high hardness, corrosion resistance, and high crack resistance among ceramic materials. By combining the two components ZrO_2 and Al_2O_3, solid and durable Al_2O_3-ZrO_2 ceramics are obtained. Due to the contribution of highly solid Al_2O_3, the phases of zirconium oxide are stabilized.

Currently, there are many ways of sintering Al_2O_3-ZrO_2 composite. One of the most novel methods that allows sintering in a short time is electron beam sintering in the forevacuum pressure region. When irradiating nonconducting ceramic materials at working gas pressures of several tens of pascals, the charging of the surface is reduced due to the plasma generated by the electron beam. In addition, as it was shown earlier, when the ceramic is heated, its electrical conductivity increases, which also helps to reduce the charge on its surface [1]. There have been no detailed studies of this phenomenon to date, which served as the subject of this study. Figure 1 shows the dependence of the current flowing through Al_2O_3-ZrO_2 ceramics when it is irradiated with an electron beam. A composite consisting of 75% (wt.) Al_2O_3 and 25% (wt.) ZrO_2 was used as a target.

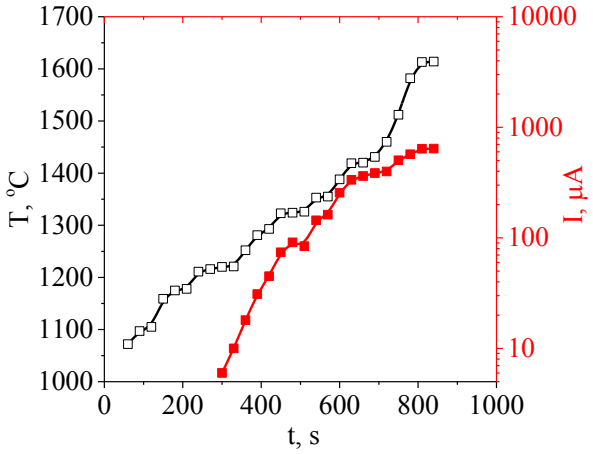

Fig.1. The dependence of temperature and current flowing through Al_2O_3-ZrO_2 ceramics during its sintering.

It can be seen that during electron-beam irradiation of the composite, the current through the sample increases with increasing temperature. The increase in current is due to an increase in the electrical conductivity of ceramics and can lead to additional heating of ceramic grains due to the flowing current. Such heating helps to reduce the sintering time of ceramics. The simulation of the current flow showed that the current value also depends on the composition of the ceramics.

REFERENCES

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