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SECONDARY ELECTRON EMISSION OF CERTAIN CERAMICS AND ANTIDYNATRON COATINGS

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ABSTRACT:
The possibility of reducing the coefficient of secondary electron emission of aluminum oxide ceramics by applying coatings of boron nitride-vanadium oxide to their surfaces was investigated. Data are presented showing that the values of the coefficient for these ceramics, used in power taps of powerful superhigh frequency devices are dangerously high, with respect to increase in secondary electron discharge. Coatings with various proportions of boron nitride and V_2O_5 effectively reduce the coefficient of secondary electron emission.

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To decrease the likelihood of formation of a secondary electron discharge (SED) in the output devices of powerful superhigh frequency electronic devices, a number of design and technological measures have been developed [1], one of which is reduction of the coefficient of secondary electron emission (csee) of dielectric materials, which are part of the energy tapping unit, to a value of $\sigma_m < 1$.

The possibility was investigated in this work of reducing the csee of 22XC and sapphirite type aluminum oxide ceramics, by means of applying a coating, based on boron nitride and vanadium oxide, to their surfaces. The csee values of the materials being studied were measured by means of a 10-position experimental device, which allows study of different materials under practically identical conditions. Directly before measurement, the samples being studied, in the form of 15 mm diameter and 1 mm thick discs, were carefully degassed for a period of 1 hour at a temperature of about 700°C. The vacuum in the apparatus was at least 5×10^{-8} torr. The csee measurements were carried out by the pulse method, with an error of no more than 10%.

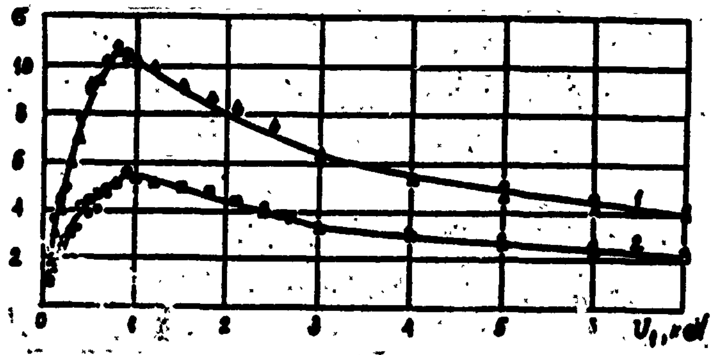

Fig. 1

The csee vs. primary electron energy $\sigma = f(U_1)$ are presented in Fig. 1 for sapphirite (1) and 22XC (2) type aluminum oxide ceramics. The data obtained show that ceramic materials used in the energy output units of powerful superhigh frequency devices have characteristics in which the csee values significantly exceed unity, which is highly dangerous, from the point of view of the intensity of increase in SED in the energy output region [2]. This primarily concerns sapphirite, for which not only are high csee values characteristic, σ_m = 10.6-10.8, but a low value of the first critical potential U_{cr1} = 40-45 V, which determines the SED onset power threshold [2]. For the 22XC ceramics, these values are σ_m = 5.5-5.6 and U_{cr2} = 55-60 V, respectively.

The curves of = $f(U_1)$ of sapphirite samples, to the surfaces of which BN-0 (1), BN-57 (2) and BN-97 (3) coatings, containing 0%, 57% and 97% boron nitride, respectively, and 100%, 43% and 3% V_2O_5, respectively, were applied. As follows from analysis of the resulting data, the csee values over the entire range of U_1 increase in proportion to increase in boron nitride content. It

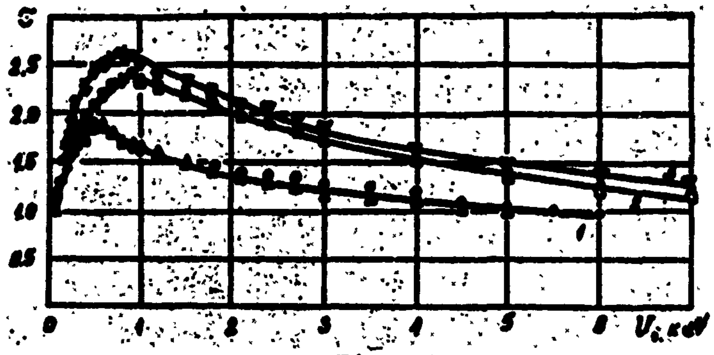

Fig. 2

must be noted that the type BN coatings studied very effectively reduce the csee of 22XC and sapphirite types vacuum ceramics and apparently others, as well.

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