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CHERENKOV RADIATION IN DIAMOND EXCITED BY ELECTRON BEAM WITH AN ENERGY OF TENS-HUNDREDS OF KEV IN A WIDE TEMPERATURE RANGE*

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Cherenkov detectors based on the Cherenkov effect are widely used to detect high-energy electron fluxes. Since Cherenkov radiation occurs only at a certain energy of a charged particle, then due to particles with energies less than this energy, radiation caused by luminescence can be detected. The parasitic contribution of luminescence to the signal of a Cherenkov detector can be especially noticeable also in the case of registration of electrons with an energy of tens to hundreds of keV. One of the promising areas of the Cherenkov detector application is thermonuclear installations, in which it is necessary to control high-energy electron fluxes from energies of tens to hundreds of keV, which can adversely affect the operation of a thermonuclear installation, up to its complete failure. Another promising area is the detection of charged particles fluxes of the solar wind in near-Earth outer space, due to which the electronic equipment of space vehicles can fail, which also entails huge financial costs. In both cases, the registration of electron fluxes must be carried out in a wide temperature range, which can reach above 500 K. Therefore, special requirements are imposed on the material of the Cherenkov detector radiator. One of the most suitable materials for a radiator, which has a high temperature and radiation resistance, as well as conductivity when excited by an electron beam, is diamond. In addition, diamond has a low Cherenkov radiation threshold (~ 50 keV), and transparency in the UV region of the spectrum (from 225 nm).

In this work, the impurity-defect composition of various samples of synthetic diamonds was studied by spectroscopic methods. Based on these studies, the most suitable samples for registration of Cherenkov radiation were selected. A chamber was made with an induction heating system and registration system of the spectral characteristics of diamond samples radiation. The study of the spectral characteristics radiation was carried out under the influence of an electron beam with an energy of tens-hundreds of keV on the RADAN-220 and NORA pulsers with a sealed-off electron tube IMA3-150E in a wide temperature range.

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