MODELING OF LUMINESCENCE SPECTRA, VAVILOV-CHERENKOV RADIATION AND SYNCHROTRON X-RAY LUMINESCENCE IN SYNTHETIC DIAMONDS*

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Due to the variety of photoreactive centers and high resistance to radiation, as well as the development of synthetic methods, diamonds are used in various fields of science and technology. Synthetic diamonds are already used as quantum sensors, radiation detectors, and monitors for the position and intensity of charged particle beams (electron, synchrotron, etc.), as well as in other high-temperature applications in electronics.

Understanding and predicting the interactions between different types of radiation and synthetic diamonds will allow us to develop advanced high-tech devices. Therefore, this topic is relevant.

This paper presents the results of simulations of cathodoluminescence and Vavilov-Cherenkov radiation in diamond crystals exposed to electron beams with energies ranging from tens of kiloelectronvolts to units of megaelectronvolts. Additionally, simulations of X-ray luminescence output in diamonds containing NV0 color centers were performed under the influence of synchrotron radiation, with the output depending on the incident angle of the radiation on the crystal. A simulation of the shape of a synchrotron beam's imprint on a crystal plane under normal incidence is also provided.

The data obtained in this work will find their application in the creation of various optoelectronic devices, such as a solar wind detector, a monitor of the position and intensity of ionizing radiation beams, etc.

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