EDGE PHOTOLUMINESCENCE IN DIAMOND: EXPERIMENT AND COMPUTATION[1]

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Ultraviolet radiation in the fundamental absorption region of the material causes an internal photoelectric effect, leading to the formation of nonequilibrium electron-hole pairs. Diamond is indirect-gap semiconductor. It is characterized by a high binding energy of a free exciton ~ 80 meV. This energy is two times higher than the energy of thermal lattice vibrations at room temperature. For this reason, in a pure diamond sample, the recombination of nonequilibrium electron-hole pairs occurs through the formation of free excitons. At high excitons concentrations and temperatures below 200 K, in bulk samples, excitons condense into droplets of an electron-hole liquid (EHL). Free excitons and EHL droplets appear in the photoluminescence spectra in the form of one-, two-, and three-phonon components of radiative recombination bands.

In this work, we present the results of experimental studies of the edge photoluminescence of diamond samples excited by laser radiation in the fundamental absorption region (λ<226 nm) and the calculated decomposition of the measured spectra into phonon components.

[1] The work was supported by the state order of the Ministry of Science and Higher Education of Russia, project No. 0721-2020-0048.