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Diamond in quantum information technologies

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Optically active centers in diamond containing vacancies and impurity atoms (N, N2, Si, Ge, etc.) are characterized by high photostability, absorption and luminescence spectra in the visible range, and characteristic luminescence times on a scale of tens of nanoseconds [1-3]. Most of these centers are relatively easy to create in a diamond during the synthesis of sample and its post-growth radiation-heat treatment.

The indicated photoactive centers are characterized by different electron-phonon interactions; therefore, a wide range of possibilities arises for quantum information technologies. NV centers are characterized by an intense phonon wing, three charge states, and spin splitting of energy levels in the case of the capture of an additional electron. N2V centers are characterized by a high efficiency of excitation by electrons from the conduction band, luminescence in the green region of the visible spectrum, and a high gain of stimulated emission. The centers containing a vacancy and an element of the fourth group (Si, Ge, Sn) are characterized by a high intensity of a phononless line and a weak phonon wing.

The report presents the results of studies of optical absorption, luminescence, excitation of spin states, and discusses the existing and possible applications of impurity-defect centers in diamond, photoactive in the green and red regions of the visible range, for problems of integral optics, quantum communications and quantum computing.

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