

The nature of laser-induced photoluminescent micro-marks in the volume of natural diamond

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Ultrashort-laser writing of optical centers in diamonds is one of the most interesting research areas with many real-life applications includes sensing, quantum communication and “stealth” luminescent micro-marking for legal tracing of natural diamonds. In this work, we investigate the nature of laser induced luminescent centers in diamond. Laser recording was carried out in the volume of natural diamonds at a wavelength of 515 nm with different intensities and exposure times without graphitization. Each series of micro-marks (matrix) was recorded at pulse durations of 300 fs, 1 ps, and 3 ps, respectively. Visualization and analysis of the luminescence of the modified regions was carried out using a scanning laser Raman microscope (Confotec MR350) with a pumping wavelength of 532 nm. We assume that the formation of micro-marks is associated with the generation of negatively-charged nitrogen-vacancy centers (NV) in the region of laser irradiation.

This work was funded by the grant of Russian Science Foundation (project No. 21-79-30063).