MAGNETOSENSITIVITY OF PHOTOLUMINESCENCE OF N_2V^0 COLOR CENTER IN DIAMOND *

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Currently, there is active development of quantum technologies, including the creation of new types of sensors and other devices [1]. A promising material for these applications is diamond, which contains various color centers. These color centers are foreign atoms embedded in the diamond lattice, associated with vacancies in the lattice structure.

Based on the registration of photoluminescence from color centers under the influence of an external magnetic field, a diamond magnetometer can be created by splitting spin sublevels due to the Zeeman effect. For NV^- centers, photoluminescence intensity decreases when exposed to an external magnetic field. However, during the experiment, a new effect was discovered that had not been previously described in the literature: when samples containing both NV^- and N_2V^0 color centers were exposed to a weak external magnetic field ($\ll$ 1 T), the photoluminescence intensity of the NV^- centers decreased, while the photoluminescence intensity of the N_2V^0 centers increased (Figure 1). This phenomenon was observed only in samples with both color centers present in their composition.

The paper presents the results of a study on the effect of an external magnetic field ($\ll$ 1 T) on the photoluminescence of NV^- and N_2V^0 diamond color centers excited by a continuous laser with a wavelength of λ = 405 nm. Temperature dependences of the effect of the external magnetic field on the photoluminescence are given, as well as the threshold value of the magnetic induction at which the effect occurs.

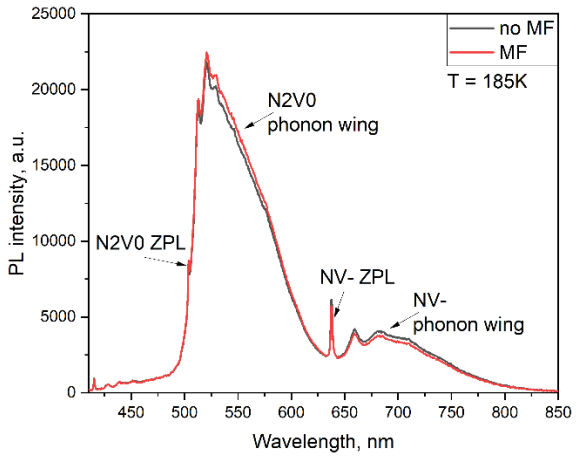

Fig.1. Photoluminescence spectra of a diamond sample in an external magnetic field (red) and without (black)

Figure 1 shows the photoluminescence spectra of a sample containing NV^- and N_2V^0 color centers in an external magnetic field and without an external magnetic field. There is an increase in the intensity of the phonon wing of the N_2V^0 center and a simultaneous decrease in the intensity of the phonon wing of the NV^- center. Based on these results, diamond quantum sensors of a new type can be created [2].

REFERENCES

[1] S. Chouaieb, L.J. Martínez, W. Akhtar, et al., "Optimizing synthetic diamond samples for quantum sensing technologies by tuning the growth temperature", Diamond and Related Materials, 96, p. 85-89, 2019

[2] Invention patent № 2023136053 «Quantum magnetometer based on N2V centers in diamond», authors: Burachenko A.G., Vince V.G., Genin D.E., Eliseev A.P., Lipatov E.I., Lyga O.I., Ripenko V.S., Chashchin V.V., Shulepov M.A., date of application 29.12.2023.

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