

NV-CENTERS LASER GENERATION IN DIAMOND*

D.E. GENIN^{1,2}, A.D. SAVVIN¹, M.A. SHULEPOV^{1,2}

¹*National Research Tomsk State University, Tomsk, Russia*

²*Institute of High Current Electronics SB RAS, Tomsk, Russia*

Diamond is a promising material for quantum electronics and photonics due to its unique properties: hardness, high thermal conductivity, big value of charge carrier mobility (for both electrons and holes), good radiation stability. Also diamond can contain colour centers that are supposed to be used as room-temperature qubits: NV, SiV, PbV, SnV etc., where V is a vacancy.

In process of quantum calculations we need laser radiation to perform initialization and reading operations. If qubits are the part of diamond lattice, it is convenient to use laser that is also based on diamond. In the future fully diamond-based quantum computer can be created.

In 2021 laser generation in diamond, containing NV-centers in the negative charge state (NV⁻), was observed for the first time ever [1]. The pulse energy was estimated as 10 nJ, the linewidth was about 15 nm at half maximum. In the current work we tried to improve the results and define the optimal impurity-defect composition of diamond sample. We managed to obtain radiation with more narrow line (approximately 6 nm) and far bigger pulse energy – up to 50 μJ.

NV⁻-laser can be applied for operations with SiV qubits. In the future we plan to obtain laser generation on other centers, which will enable to operate NV⁻ qubits.

REFERENCES

- [1] Savvin, A., Dormidonov, A., Smetanina, E. et al. “NV– diamond laser”, Nat Commun 12, 7118 (2021)

* The study was carried out on the state order of the Ministry of Science and Higher Education of the Russian Federation, project № 0721-2020-0048.