

GeV, SiV and NV color centers in single crystal diamond needles

S.A. Malykhin^{1,2,3}, R.R. Ismagilov², A.S. Orekhov⁴, E.A. Obraztsova⁵, A.N. Obraztsov^{1,2}

¹Department of Physics and Mathematics, University of Eastern Finland, Joensuu, Finland

²Department of Physics, Lomonosov Moscow State University, Moscow, Russia

³Lebedev Physical Institute, Russian Academy of Sciences, Moscow, Russia

⁴Russian Research Centre Kurchatov Institute, Moscow, Russia

⁵Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences, Moscow, Russia
sermat92@mail.ru

Single crystal diamond needles (SCDN) were produced by combination of chemical vapor deposition (CVD) and selective oxidation techniques. Necessary properties of fabricated film material are determined by parameters of the CVD process including substrate temperature gas mixture composition and direct plasma discharge glowing. Optimization of these parameters of the CVD process allows us to create carbon film consisting of SCDNs with different geometries [1]. Injection of nitrogen, silicon and germanium containing precursors into the CVD chamber and further optimization of the process parameters allows us creation of nitrogen-vacancy (NV), silicon-vacancy (SiV) and germanium-vacancy (GeV) color centers in SCDNs. Optical properties of obtained SCDNs with NV, SiV and GeV color centers were investigated using photo- and cathodoluminescence (PL and CL) techniques. Morphological properties were analyzed using scanning electron microscopy (SEM). PL spectra of NV⁰, SiV⁻ and GeV color centers created in SCDNs presented in Fig.1.

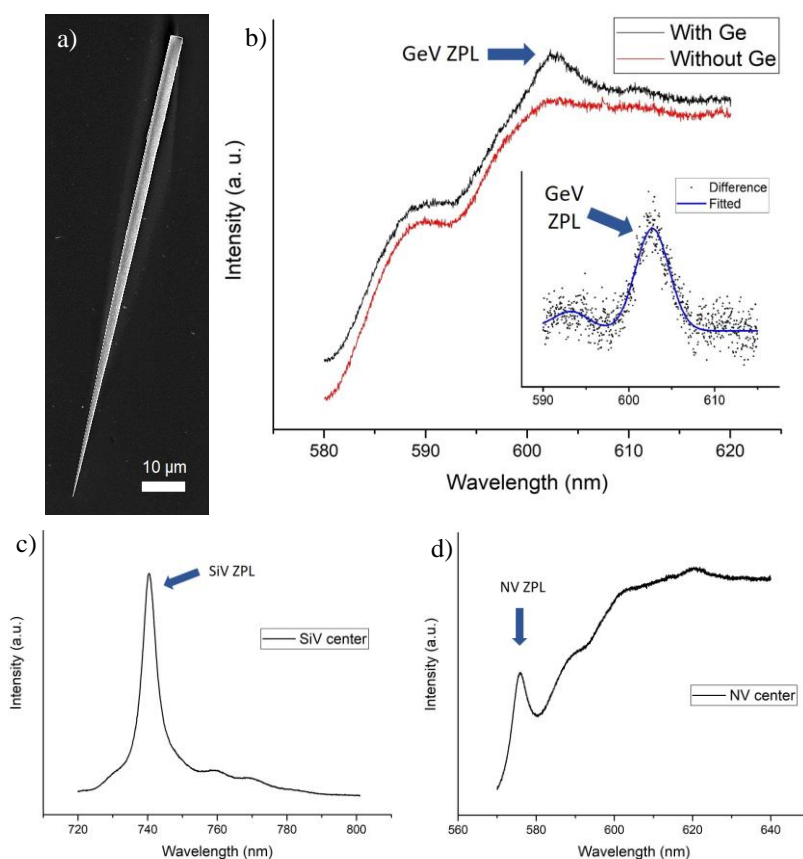


Fig. 1. SEM image of SCDN (a) and PL spectra of GeV (b), negative SiV (c), neutral NV (d) color centers in it. Zero phonon lines of these centers marked by blue arrows [2,3].

The PL bands of GeV are revealed via comparison of PL spectra detected for material obtained with and without Ge injection as it is demonstrated in Fig.1(b) presenting PL spectra of SCDNs containing GeV color centers, without GeV and their difference in the box for clarity.

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