Single photon source in nanodiamonds for integrated quantum photonic

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The negatively charged silicon-vacancy (SiV^-) centers in diamonds have emerged as a very promising candidate for quantum emitter (QE) due to their narrow emission line. Modifying the emission properties and enhancing the interaction strength of such QE coupled to nanophotonic structures, based on dielectric waveguide, is a challenge for integrated quantum photonic.

This work aims to study and compare optical properties of SiV centers in nanodiamonds prepared under the same HPHT conditions but treated by two different methods (vacuum treatment and hydrogen-treatment) and its coupling with a waveguide in glass. We first present the effect of H-treatment on the isolation of SiV per ND and verify the feasibility of SiV as single photon source. Using a confocal microscope incorporated into a Hanbury Brown and Twiss (HBT) setup, the antibunched nature of the fluorescence light emitted by this source is revealed. Moreover, we present the evolution of the autocorrelation curves as function of the power of excitation.

Keywords : SiV, waveguide in glass, integrated quantum photonic, H-treatment, single photon source, confocal microscope, HBT, antibunching.

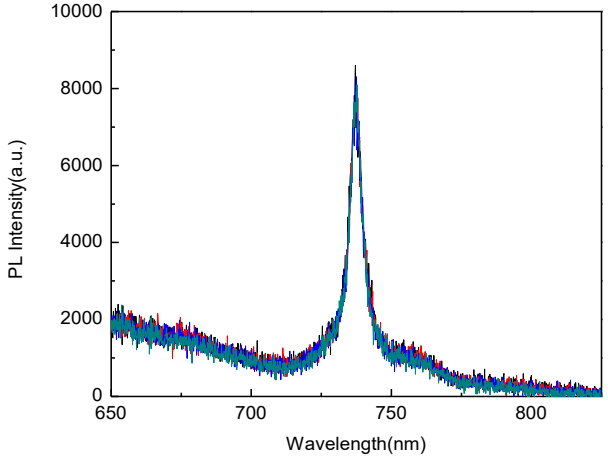

Figure 1: PL spectra of SiV in nanodiamond exhibit a narrow emission line.

References

[1] R. Evans, A. Sipahigil, “Narrow-Linewidth Homogeneous Optical Emitters in Diamond Nanostructures via Silicon Ion Implantation”, PHYSICAL REVIEW APPLIED 5, 044010 (2016)

[2] L. Rogers, V. Davydov, V. Agafonov, “Single SiV centers in low-strain nanodiamonds with bulk-like spectral properties and nano-manipulation capabilities”, Preprint at arXiv:1802.03588v2 (2018).