Novel 990 nm Emission Peak from Fluorine Implanted Diamond

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Color centers in wide bandgap semiconductors have shown significant promise as the backbone for a number of quantum technologies. The most studied host material to date is diamond, due to the presence of the ODMR-active NV center and its lattice possessing many desirable qualities for the formation of single-photon-emitting defect centers.

Nevertheless, diamond has a propensity for defect centers fluorescing in the visible range, which is strongly absorbed by silica fiber optic. If one wishes to transmit single photons from a color center over long distances, longer wavelengths are highly desirable. Hence, the discovery of a 990 nm emission peak in fluorine implanted diamond in electroluminescence and cathodoluminescence (Fig. 1) does warrant further examination to identify its source. In their paper [1], the first on the subject, the authors tentatively attribute this peak to negatively charged substitutional fluorine, as its wavelength is close to the value predicted by P.-P. Filippatos *et al.* [2], whose work also suggests that the defect would have a triplet ground state with optically addressable transitions.

In the published measurements, however, the fluorine implanted diamond has shown no 990 nm photoluminescence under several optical excitation wavelengths (Fig. 1c). Efforts are underway to search for photoluminescence in a broader range of conditions. The presenter wishes to discuss the published measurements, as well as the preliminary results from the current work, with the goal of building an understanding of the source of this emission.

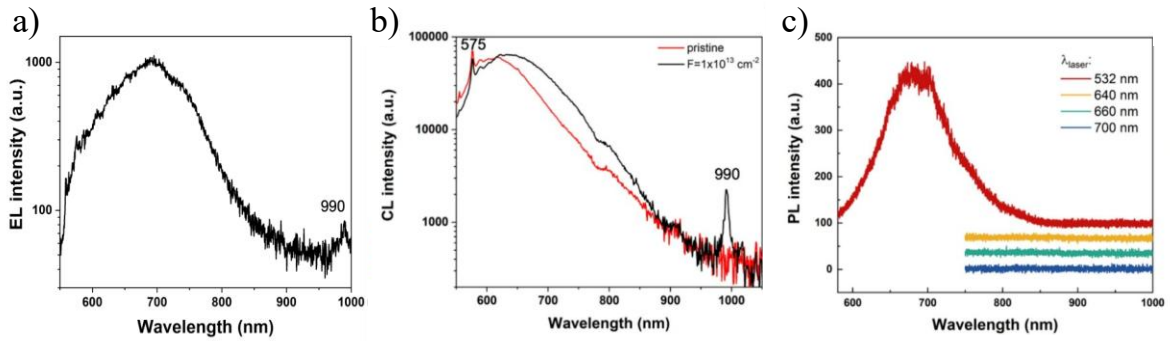

Fig. 1: *fluorescence spectra of fluorine implanted diamond under different excitation sources a) electroluminescence, b) cathodoluminescence, c) photoluminescence. Spectra under different laser wavelengths are shown with a vertical offset for ease of comparison. Notice that lack of the 990 nm emission peak in panel c).*

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References

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