First Observation of Fluorescence above 1200 nm from a Silicon-Related Colour Centre in Diamond

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Fluorescent colour centres in diamond are important room temperature quantum systems which have emerging applications in areas such as quantum communication and biosensing. Colour centre emission from diamond in the near infrared region above 1 μm has the potential to reduce optical loss in quantum communication devices and increase the imaging depth for biosensing applications. However, at present, very few fluorescent colour centres in diamond have been identified with emission above 1 μm.

We present the first observation and characterisation of a photoluminescence (PL) colour centre in diamond with a zero phonon line at 1220 nm accompanied by a number of prominent phonon side band replicas [1]. This new colour centre has been observed in Si-doped micro- and nano-diamonds previously observed to exhibit silicon-vacancy (SiV^-) and silicon-boron (SiB) centres in the 700-950 nm region [2].

The temperature dependence, excitation power and wavelength, and the lifetime of the PL from this centre have been examined. In addition, the PL line shape exhibits a strong temperature dependence. Furthermore, the highly photostable emission from this NIR colour centre reveals the potential for a range of long time scale applications.

1. S. Mukherjee, Z. Zhang, M.O. de Vries, A. Stacey, B.C. Johnson, B.C. Gibson, P. Reineck, and N. de Leon, *manuscript in preparation*
2. A.I. Shames, A. Dalis, A.D. Greentree, B.C. Gibson, H. Abe, T. Ohshima, O. Shenderova, A. Zaitsev, and P. Reineck, *Adv. Opt. Mater.* **2020**, *8*, 1