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Native NIR-emitting single colour centres in CVD diamond

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Abstract

Single-photon sources are a fundamental element for developing quantum technologies, and sources based on colour centres in diamonds are among the most promising candidates. The well-known nitrogen vacancy centres are characterized by several limitations, and thus few other defects have recently been considered. In the present work, we characterize, in detail, native efficient single colour centres emitting in the near infra-red ($\lambda = 740$–780 nm) in both standard IIa single-crystal and electronic-grade polycrystalline commercial chemical vapour deposited (CVD) diamond samples. In the former case, a high-temperature ($T > 1000$ °C) annealing process in vacuum is necessary to induce the formation/activation of luminescent centres with good emission properties, while in the latter case the annealing process has marginally beneficial effects on the number and performance of native centres in commercially available samples. Although displaying significant variability in several photo-physical properties (emission wavelength, emission rate instabilities, saturation behaviours), these centres generally display appealing photophysical properties for