Controllable Fabrication of Blue Quantum Emitters in Hexagonal Boron Nitride

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Hexagonal boron nitride (hBN) is gaining considerable attention as a solid-state host of quantum emitters from the ultraviolet to the near-infrared spectral ranges.[1] For integration into real-world applications several challenges must be overcome, including a limited knowledge of the atomic structures of most quantum emitters and poor control over location, spectral position and reproducibility in fabrication.

This work presents a precise technique to activate quantum emitters in hBN using electron irradiation via a scanning electron microscope.[2] A high level of spatial accuracy is shown as well as a spectrally consistent zero-phonon line at 436 nm (2.8 eV). An ability to create both isolated single photon emitters with a 33% yield as well as ensembles is demonstrated with emission intensity proportional to electron dose. Using cathodoluminescence measurements a strong link to a well-studied defect related emission at 305 nm (4.1 eV) has also been uncovered with a pre-irradiation annealing treatment enhancing the efficacy of the fabrication technique.

[1] Turunen, M., et al., *Nat. Rev. Phys.* **4**, 219-236 (2022).

[2] Gale, A., et al., *ACS Photonics.* **9.6**, 2170-2177 (2022).