High-quality blue quantum emitters in hexagonal boron nitride without background fluorescence.

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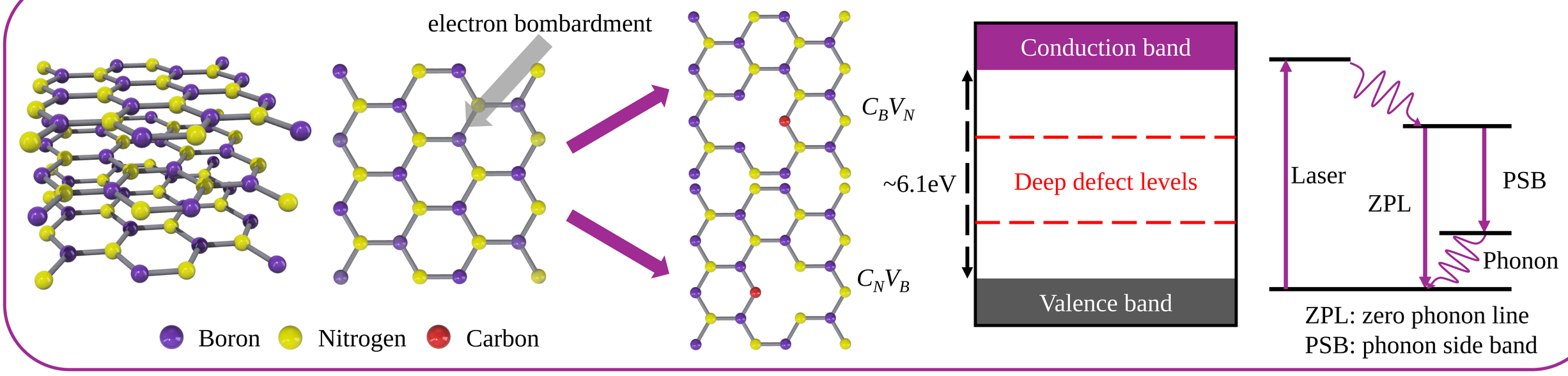
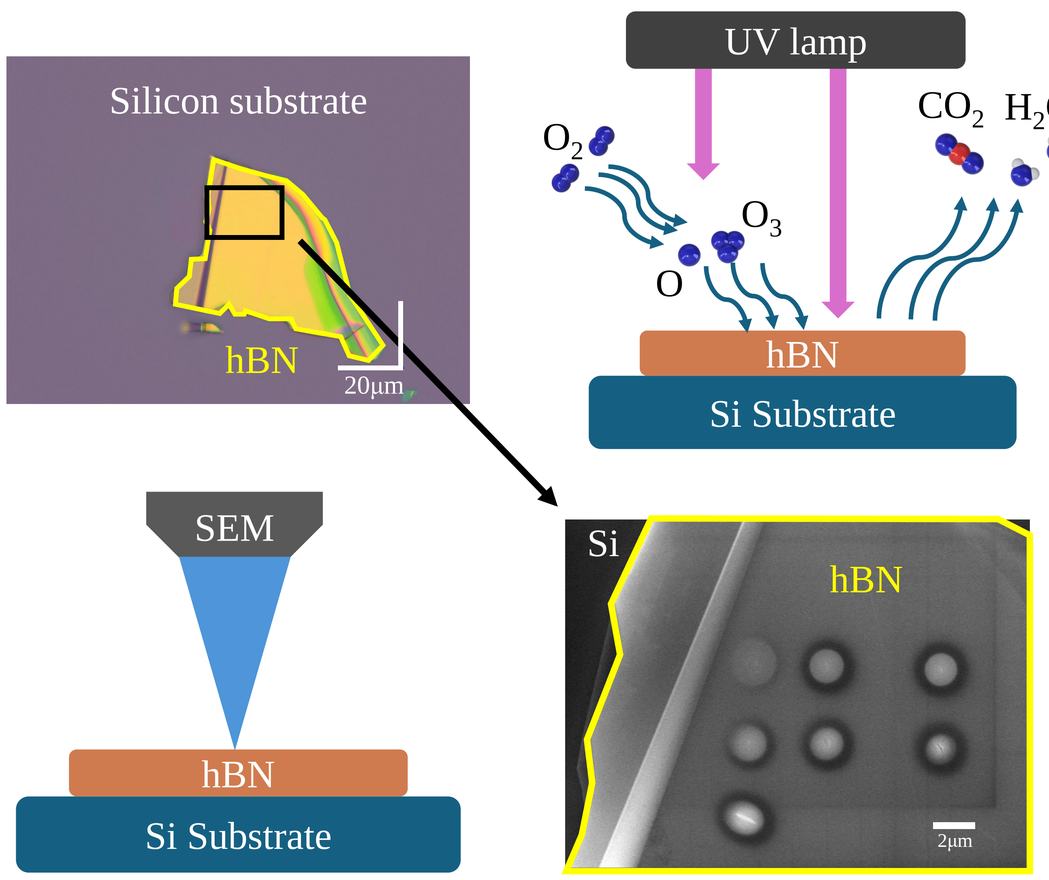
Abstract

Single-photon sources in wide-band gap hexagonal boron nitride (hBN) hold great promise for applications in quantum communication and quantum key distribution. However, the production of high-quality quantum light sources in hBN remains a challenge. In this work, we focus on fabricating blue quantum emitters (near 436 nm) via electron bombardment, combined with thermal annealing and plasma treatment to effectively eliminate background fluorescence. By removing surface contaminants that previously caused spectral interference, we achieve stable and clean quantum dots. Polarization-resolved photoluminescence measurements further demonstrate excellent crystal alignment. Our findings are crucial for advancing defect engineering and practical applications of quantum optical technologies.

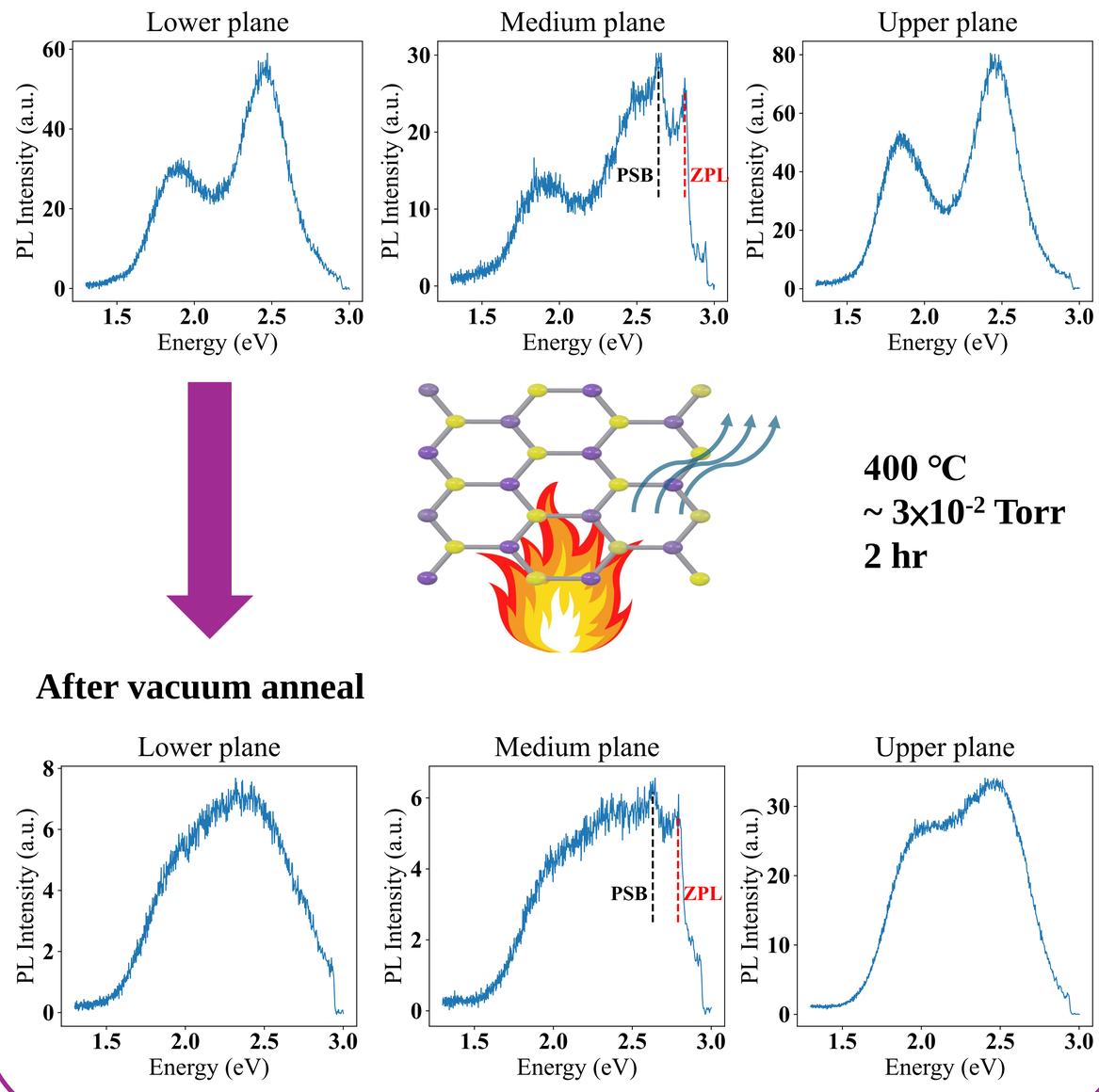
Introduction



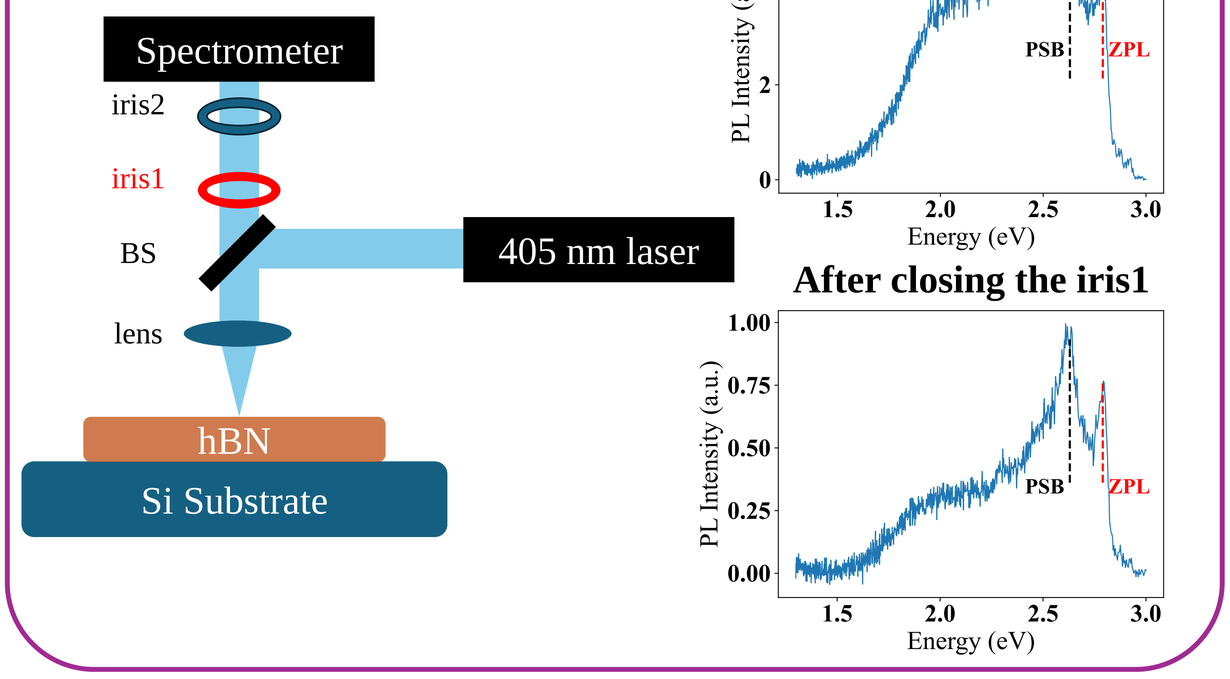
Sample Preparation



Vacuum Anneal



Multi-direction Background Fluorescence



Conclusion

1) After 400°C vacuum annealing for 2 hours, a portion of the background fluorescence disappeared.
2) A portion of background fluorescence seems not to follow the same path with blue quantum emitter.

Reference and Acknowledgement

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