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Dimension Control of In Situ Fabricated Perovskite Nanocrystals toward Efficient Blue Light-Emitting Diodes

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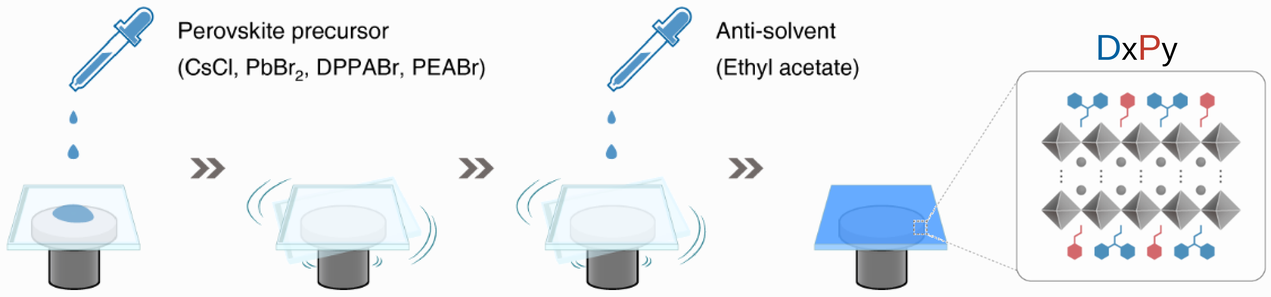
Abstract

Metal halide perovskite is emerging as an attractive optoelectronic material due to its high color quality and easy fabrication process. The performance of blue perovskite LEDs lags behind their green and red counterparts, which is an obstacle to develop full-color display technology.

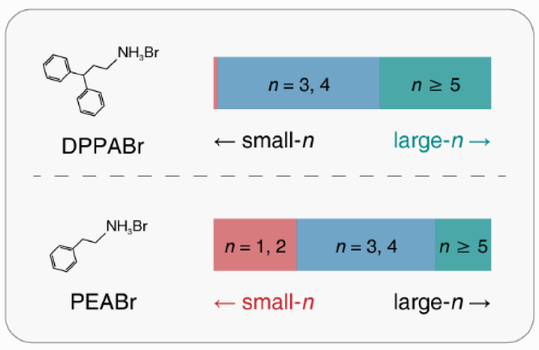
Herein, we demonstrate the in situ fabrication of $CsPbClBr_2$ nanocrystals by mixing two ligands PEABr and DPPABr. The optimized film shows a narrower quantum well width distribution, which results in efficient energy transfer and radiative recombination. Based on the dimension control strategy, efficient blue PeLEDs with a maximum EQE of 8.8% were achieved at 473 nm.

Main Ideas

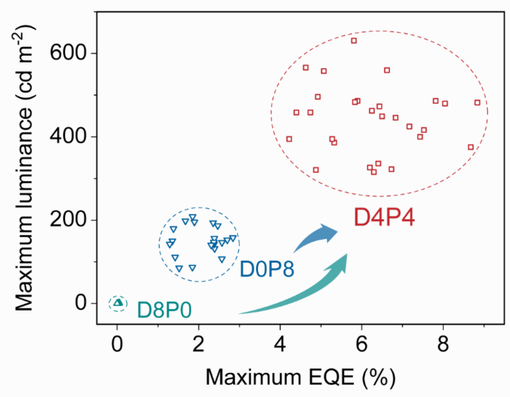
a) In situ fabrication of perovskite films



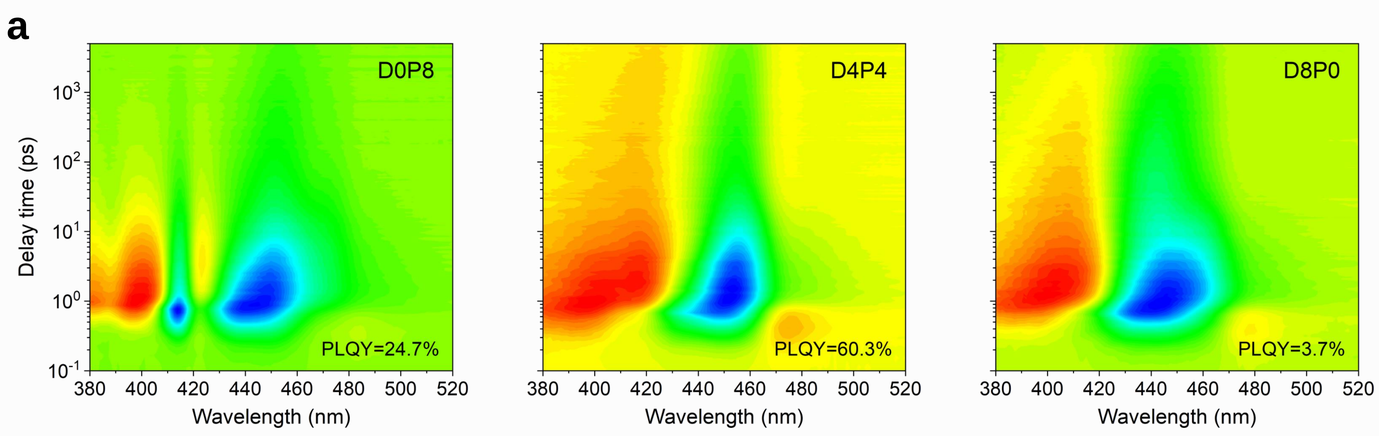
b) Quantum well width distribution

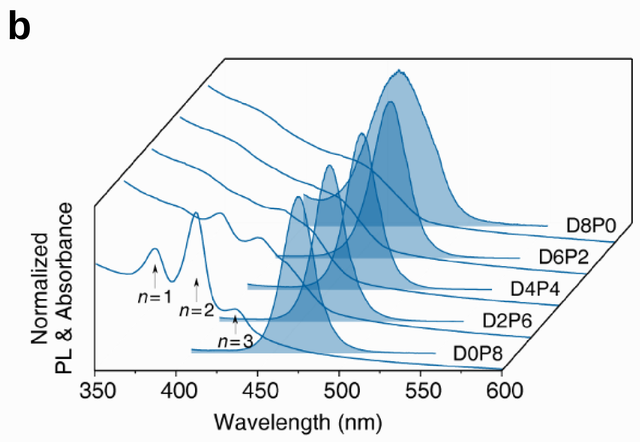


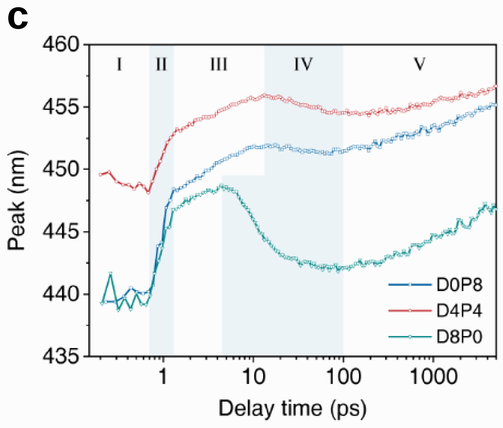
c) Device performance

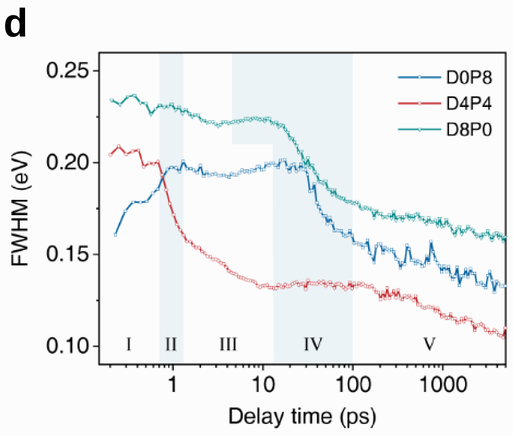


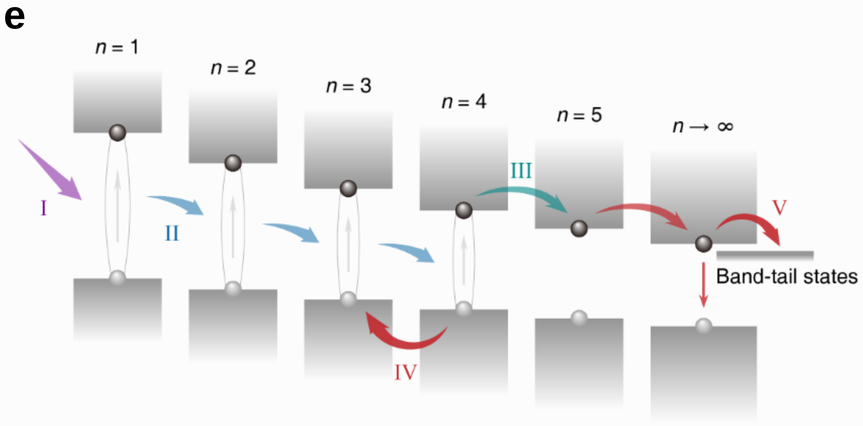
Spectroscopic Characterizations & Carrier Dynamics



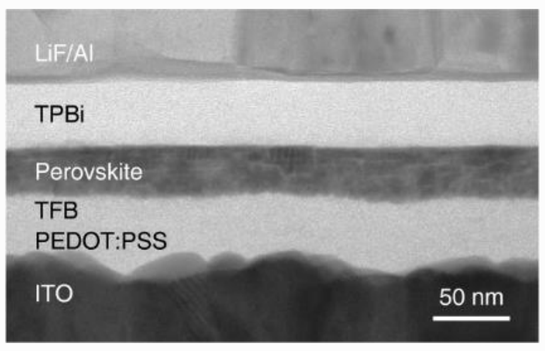


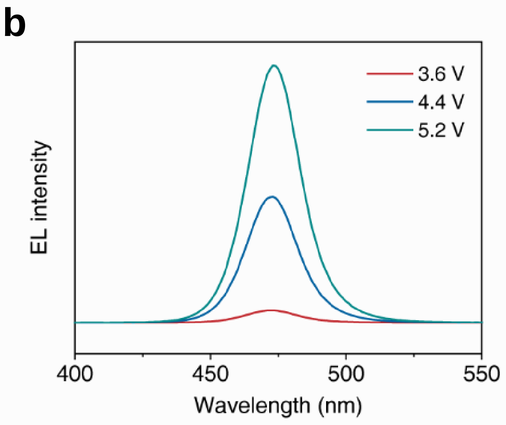


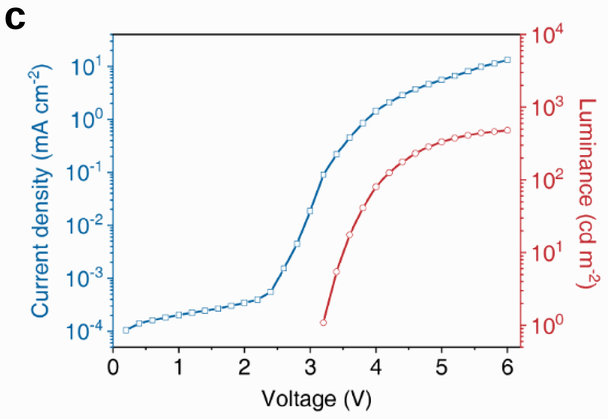


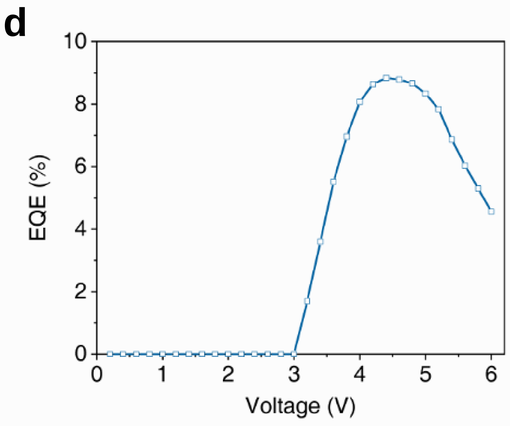


Efficient Blue Light-Emitting Diodes









Conclusion

We demonstrate efficient blue perovskite light-emitting diodes with a maximum EQE of 8.8% at 473 nm. The mixed use of the two ligands with respective tendency of forming small-*n* and large-*n* domains reduces the content of small-*n* domains while narrows the quantum well width distribution for realizing effective energy and charge transfer, which results in efficient blue emission.

Acknowledgement

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