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Bridging the Gap between Photoluminescence and Electroluminescence of Quantum Dots

Date: May 4th 2021, 10.00 h Hamburg time

Colloidal quantum dots (QDs) are promising emitters for QD-based light-emitting-diodes (QLEDs). In 2014, it was demonstrated that, through inexpensive solution processing, QLEDs can be made to deliver outstanding performance for real-life applications. [1] However, though QDs have been synthesized with efficient, stable, and high colour-purity photoluminescence, inheriting their superior luminescent properties in QLEDs remains challenging. This is commonly attributed to unbalanced charge injection and/or interfacial exciton quenching in the devices. [2] A general but previously overlooked degradation channel in QLEDs, i.e., operando electrochemical reactions of surface ligands with injected charge carriers, is identified, which creates a substantial gap between photoluminescence and electroluminescence. [3] This gap, in principle, can be closed by developing electrochemically-inert ligands to QDs with excellent luminescent properties. This strategy is generally applicable for boosting electroluminescence efficiency and operational lifetime of the QLEDs with different types of QDs and different emitting colours.

References

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