Scientists obtain broad-band single-mode lasers in colloidal quantum dots

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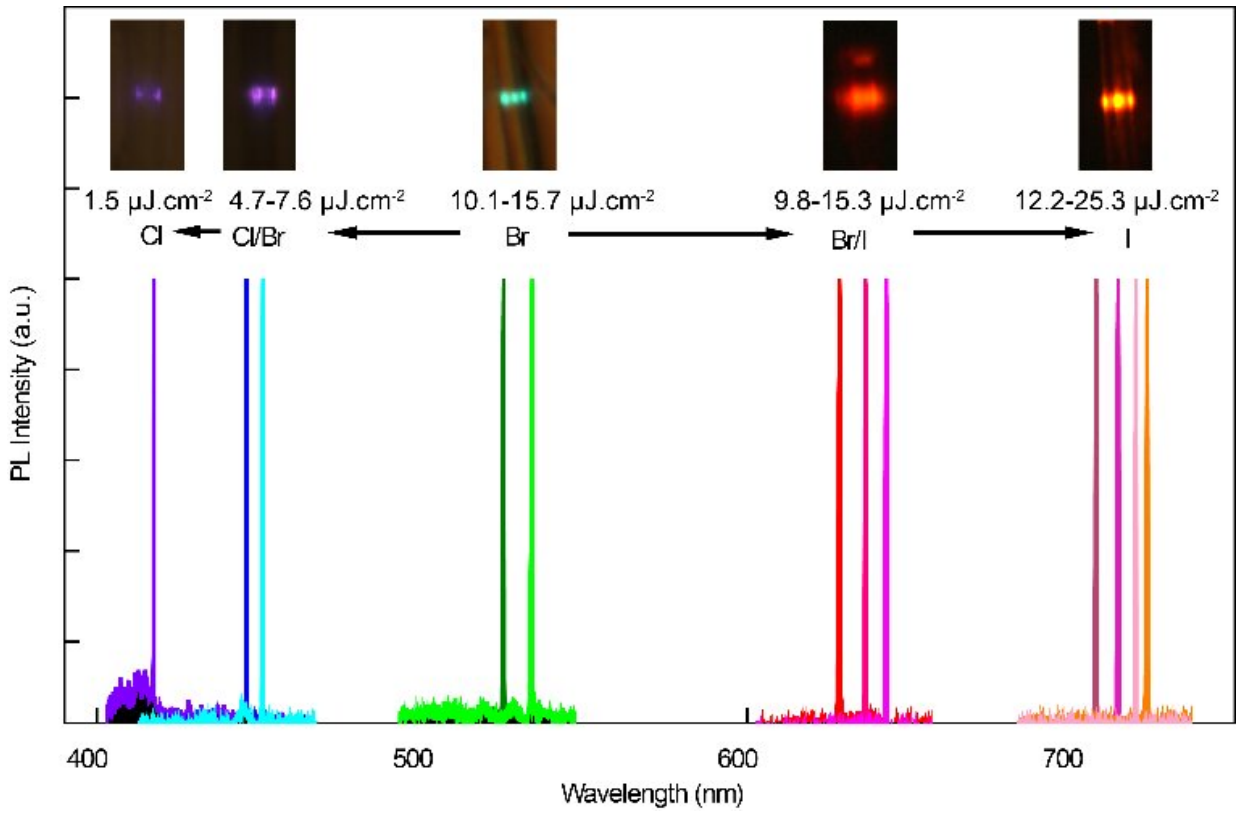

Broad-band CQDs single-mode lasers in CQDs/ZnO composited microcavity. Credit: SIOM

In the past two decades, great efforts have been made to achieve lasers based on colloidal quantum dots (CQDs), especially CQD-based single-mode lasers, which is important in on-chip optical processing and data

storage due to low noise and good monochromaticity.

Although there are concrete demonstrations of solution-processed CQDs films enabled optical microcavities, the radiation collected from the samples exhibits random lasing, or multi-mode lasing due to low coupling efficiency, low quality factor, and it's often difficult to control laser mode. Thus, CQDs based single-mode lasers across the whole visible spectral range haven't been achieved yet.

A research team from the Shanghai Institute of Optics and Fine Mechanics has recently demonstrated perovskite CQDs single-mode laser with good performance across the entire visible spectra range. The work was published in the *Journal of Materials Chemistry C*.

In this study, a composited microcavity was obtained through the conformal deposition of cesium lead halide perovskite (LHP) CQDs on a high quality individual sub-micron ZnO rod by dip-coating self-assembled techniques. A single-mode lasing with high quality factor and low threshold was obtained.

By tuning the size of ZnO microrods, size of CQDs, and the elements of CQDs, broad-band tunable single-mode lasers can be achieved in the whole visible spectra region.

Experiments, together with theoretical studies, analyzed the physical mechanism and output performance of QDs laser and proposed that the efficient coupling between CQDs and microcavity is key to efficient and high-quality lasing.

More information: Chun Zhou et al. Broad-band lead halide perovskite quantum dot single-mode lasers, *Journal of Materials Chemistry C* (2020). DOI: 10.1039/D0TC02551H

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