International Workshop on Advanced Display Materials

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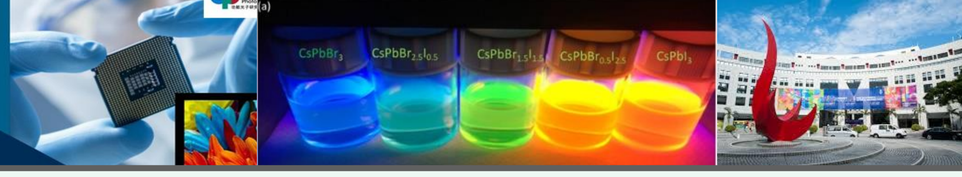

Inorganic quantum dots for solar cell applications

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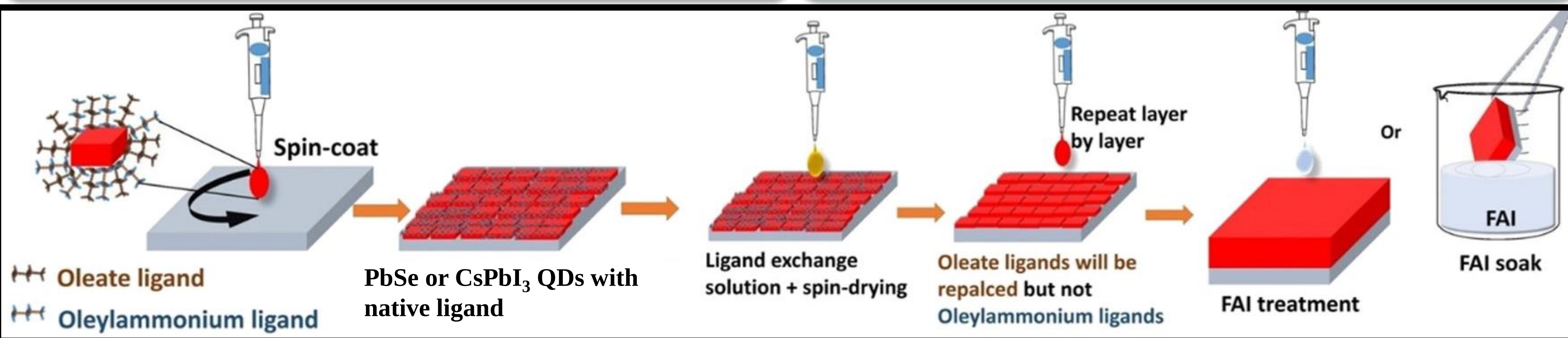
Introduction

- **Colloidal quantum dots (QDs) are promising photovoltaic materials**
- **Colloidal QDs offer unique features such as ease of synthesis, tunability of bandgap, tunable surface chemistry and high PLQY.**
- **Superior transparency over bulk perovskites**

Methodologies

- **Synthesis: Typical hot injection method or room temperature synthesis**
- **Fabrication: spin-coating, spray coating**
- **Layer-by-layer (LBL) fabrication builds optimum thickness**
- **Ligand exchanging : Solid phase or solution phase**
- **Device: regular structure (n-i-p) or inverted (p-i-n)**



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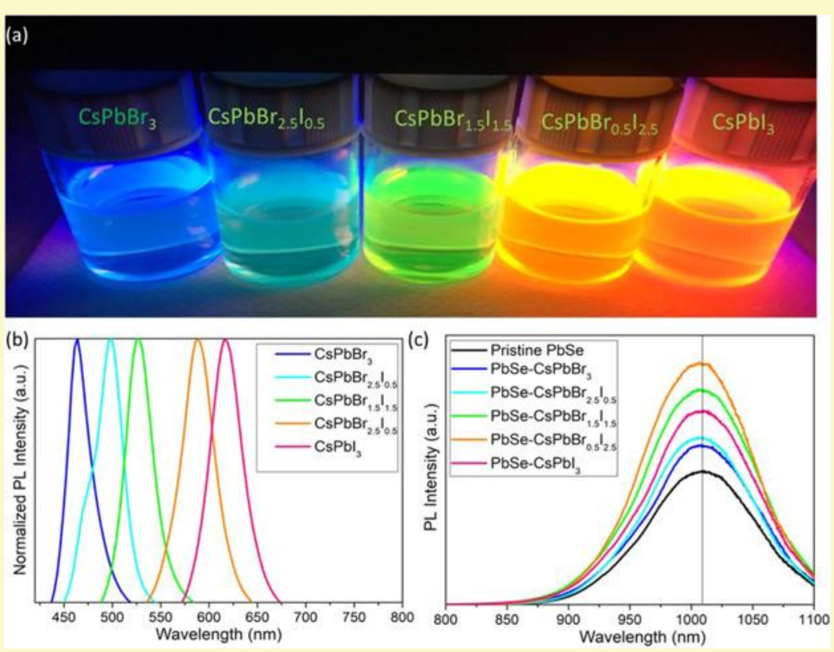
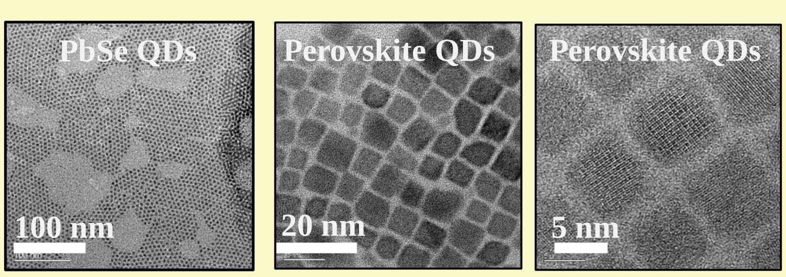


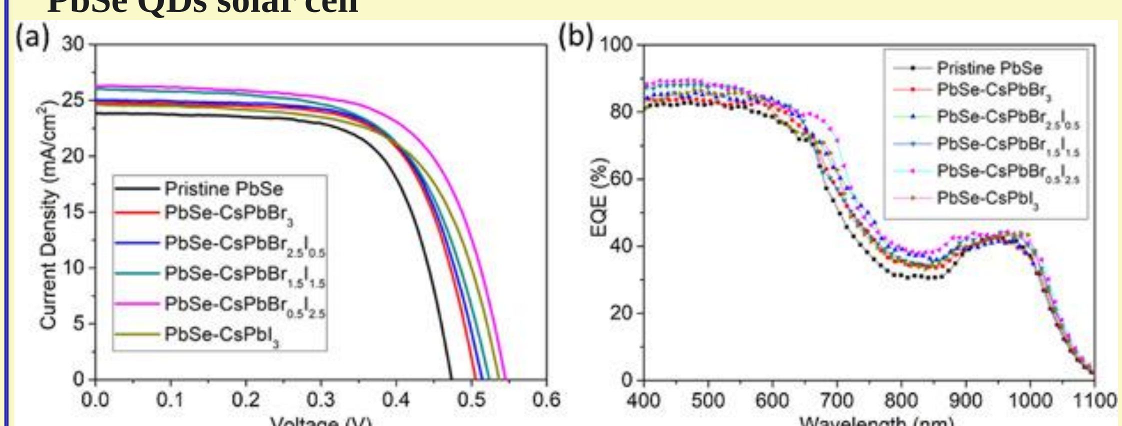
a) Photo of perovskite nanocrystals under UV illumination. b) Steady state PL spectra of the samples. c) The steady state PL spectra of pristine PbSe and treated PbSe QDs [Hu *et al.*]

Transmission electron microscope images



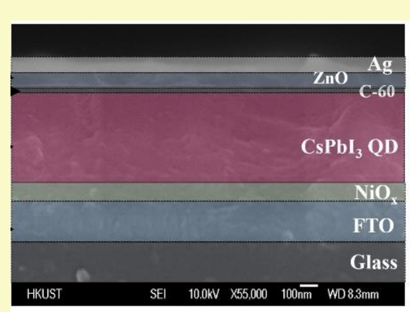
Device characterisation

PbSe QDs solar cell

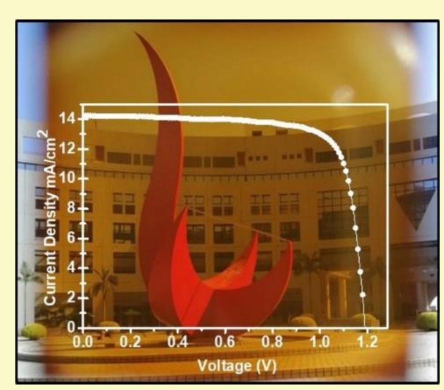


Current density-voltage (*J-V*) (a) and EQE (b) curves of the champion devices fabricated from pristine PbSe QDs and five samples of treated PbSe QDs.

CsPbI$_3$ QDs solar cell



SEM cross-section of the device



Current density-voltage (J-V) of CsPbI3 QDs

Pristine PbSe: V_{oc}=0.49 , J_{sc}=23.9, FF=0.60 PCE =7.0 %

Champion PbSe-CsPbBr$_{0.5}$I$_{0.5}$: V_{oc}=0.49 , J_{sc}=23.9, FF=0.60 PCE =7.0 %

Inverted CsPbI$_3$: V_{oc}=1.19 , J_{sc}=14.20, FF=0.77 PCE =13.10 %

■ REFERENCES

- Shivarudraiah, et al.. "All-inorganic, solution processed, inverted CsPbI3 quantum dot solar cells with PCE 13.1% achieved via LBLFAI treatment." ACS Applied Energy Materials (2020).
- Hu et al. "PbSe Quantum Dot Passivated Via Mixed Halide Perovskite Nanocrystals for Solar Cells With Over 9% Efficiency." Solar RRL (2018)

■ ACKNOWLEDGMENTS

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