**Colloidal perovskite quantum dots for record-efficiency and phase stable solar cell**

*Mengmeng Hao, Yang Bai\*, Lianzhou Wang\**

Nanomaterials Centre, School of Chemical Engineering and Australian Institute of Biotechnology and Nanotechnology, The University of Queensland, St Lucia, QLD 4072, Australia

\*Corresponding Author’s E-mail: y.bai@uq.edu.au l.wang@uq.edu.au.

Solution processed halide perovskite quantum dots (PQDs) are in great potential as materials for efficient light emitting and solar cell technologies, which is attribute to their unique optoelectronic properties and facile fabricating route for large scale and flexible devices. However, PQDs obtained from reported synthesis approaches have abundant defects that are detrimental to charge transport, which curtails the power conversion efficiency (PCE) of QD solar cells (QDSCs). We demonstrate an effective strategy to synthesize PQDs with significant reduction of defect density and improved phase stability. The hero QDSC achieves a certified record PCE of 16.6% with negligible hysteresis. We further demonstrate that the QD devices exhibit substantially enhanced operational stability, retaining 94% of the original PCE under 1-sun continuous illumination for 600 hours at open-circuit.