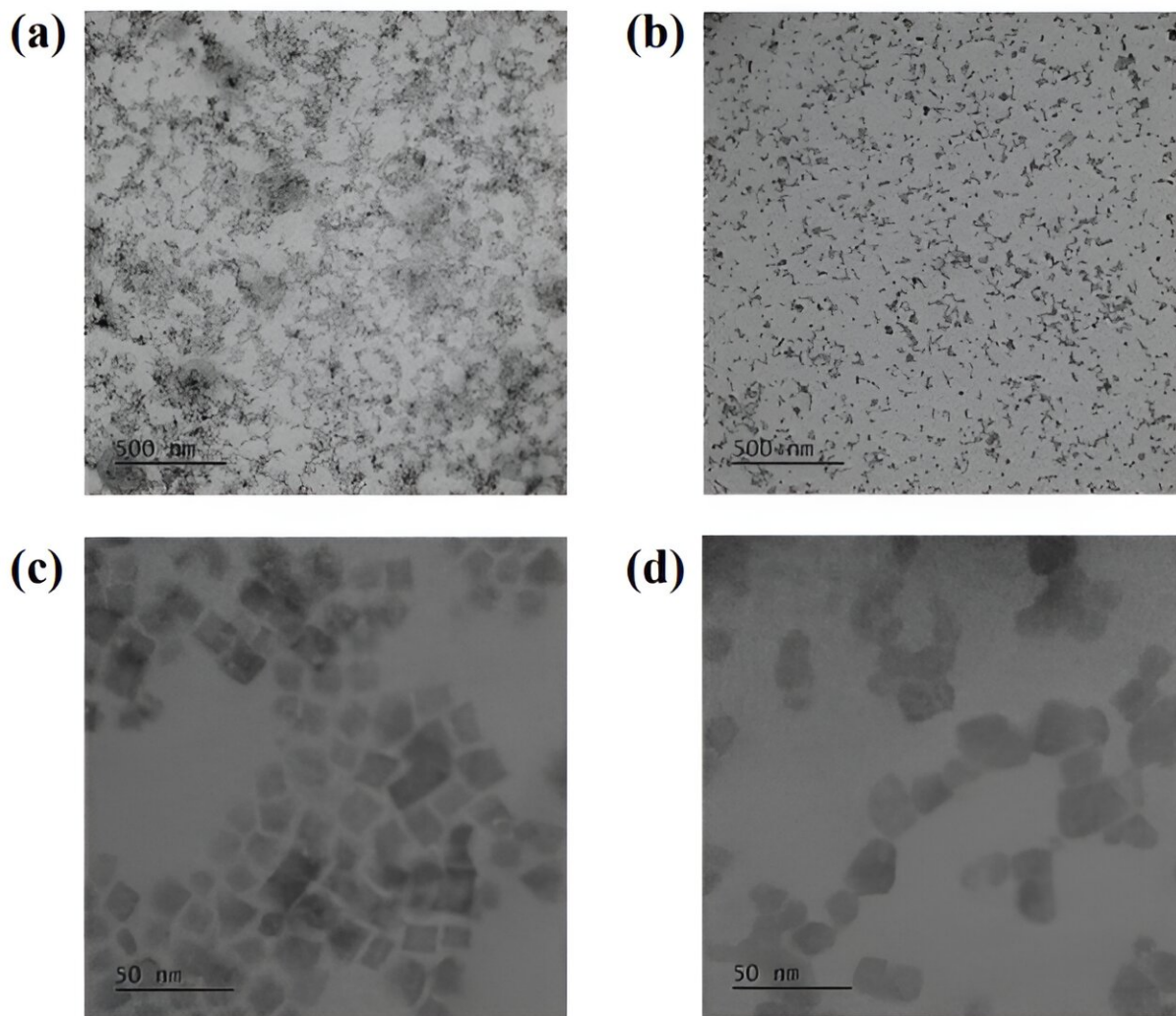


Researchers report efficiency breakthrough for narrow-bandgap perovskite cells

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TEM images of (a and c) pristine-PQD and (b and d) IPA-treated PQD with different magnifications. Credit: *Advanced Energy Materials* (2024). DOI: 10.1002/aenm.202304276

A research team, led by Professor Sung-Yeon Jang in the School of Energy and Chemical Engineering at UNIST has achieved a significant advancement in solar cell technology. Through a collaborative effort with Professor Sang Kyu Kwak and his team at Korea University, the researchers have developed a technology that greatly enhances the efficiency of solar cell devices by integrating tin–lead halide perovskites (TLHPs) photoactive layers with quantum dot layers.

[The study](#) is published in *Advanced Energy Materials*.

The key innovation lies in the creation of a thin film layer that bonds the combined materials, resulting in a substantial increase in battery efficiency. This bonding layer strengthens the internal electric field, reduces defects at the interface, and enhances the movement of electric charges, thereby improving charge extraction efficiency.

One of the challenges with tin–lead halide complexes is their limited energy gap between bands, despite their excellent light absorption capabilities in the near-infrared region. The presence of internal defects and short charge movement distances has hindered stable charge extraction in the past.

To address this issue, the research team coated perovskite quantum dots with a thin film over the tin–lead perovskite layer, effectively mitigating the chronic problem and improving stability.

By applying quantum dot material to the TLHP film surface, the researchers significantly reduced surface defects on the quantum dot, enhancing the stability of the thin film. Moreover, the alignment of energy levels and efficient collection of electric charges, enabled by the unique properties of the materials, now allow for enhanced electron

extraction and increased extraction of electric charges generated by sunlight.

The solar cell device fabricated using this advanced technology achieved a record-breaking photoelectric conversion efficiency of 23.74% for TLHPs, marking a substantial improvement over the 19% efficiency achieved using existing methods—an increase of approximately 20%.

Professor Jang emphasized the significance of the integration of quantum dot and perovskite solar cell technologies, highlighting the potential for high-efficiency solar cells in the future. This research breakthrough opens up new possibilities for the development of next-generation solar cells with enhanced performance and efficiency.

More information: Muhibullah Al Mubarak et al, Regulating the Quantum Dots Integration to Improve the Performance of Tin–Lead Perovskite Solar Cells, *Advanced Energy Materials* (2024). [DOI: 10.1002/aenm.202304276](https://doi.org/10.1002/aenm.202304276)

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