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English translation

### Research Frontier: Nature Energy – capping materials for perovskite solar cells

Three-dimensional/low-dimensional perovskite solar cells have improved efficiency and stability. Since  $\text{Pb}^{2+}$  (lead ions) and  $\text{Sn}^{2+}$  (tin ions) are the only choices for metal cations, the design of low-dimensional capping materials is limited to the regulation of A-site organic cations.

Recently, Senyun Ye, Haixia Rao, Yeng Ming Lam, Tze Chien Sum and others from Nanyang Technological University in Singapore published a paper in Nature Energy, based on the processing of complete precursor solutions containing metals and ammonium halides, which allowed a library of low-dimensional capping materials for metal cations other than  $\text{Pb}^{2+}/\text{Sn}^{2+}$  to be accessed. This enables easier synthetic control of low-dimensional capping layers and greater versatility for low-dimensional interface engineering.

The study demonstrates that zero-dimensional zinc-based halometallates ( $\text{PEA}_2\text{ZnX}_4$ ; PEA = phenethylammonium,  $\text{X} = \text{Cl/I}$ ) induce stronger surface passivation and stronger N–N isomorphic three-dimensional / low-dimensional heterojunctions than its lead-based counterparts. Experiments demonstrated a p–i–n solar cell efficiency of 24.1% (23.25% certified). After more than 1,000 hours of operation at the maximum power point, the battery can still maintain 94.5% of the initial efficiency.

This discovery expands the library of materials for low-dimensional interface engineering and stable and efficient 3D/low-dimensional perovskite solar cells.

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