Researchers develop new perovskite solar cells that set efficiency record

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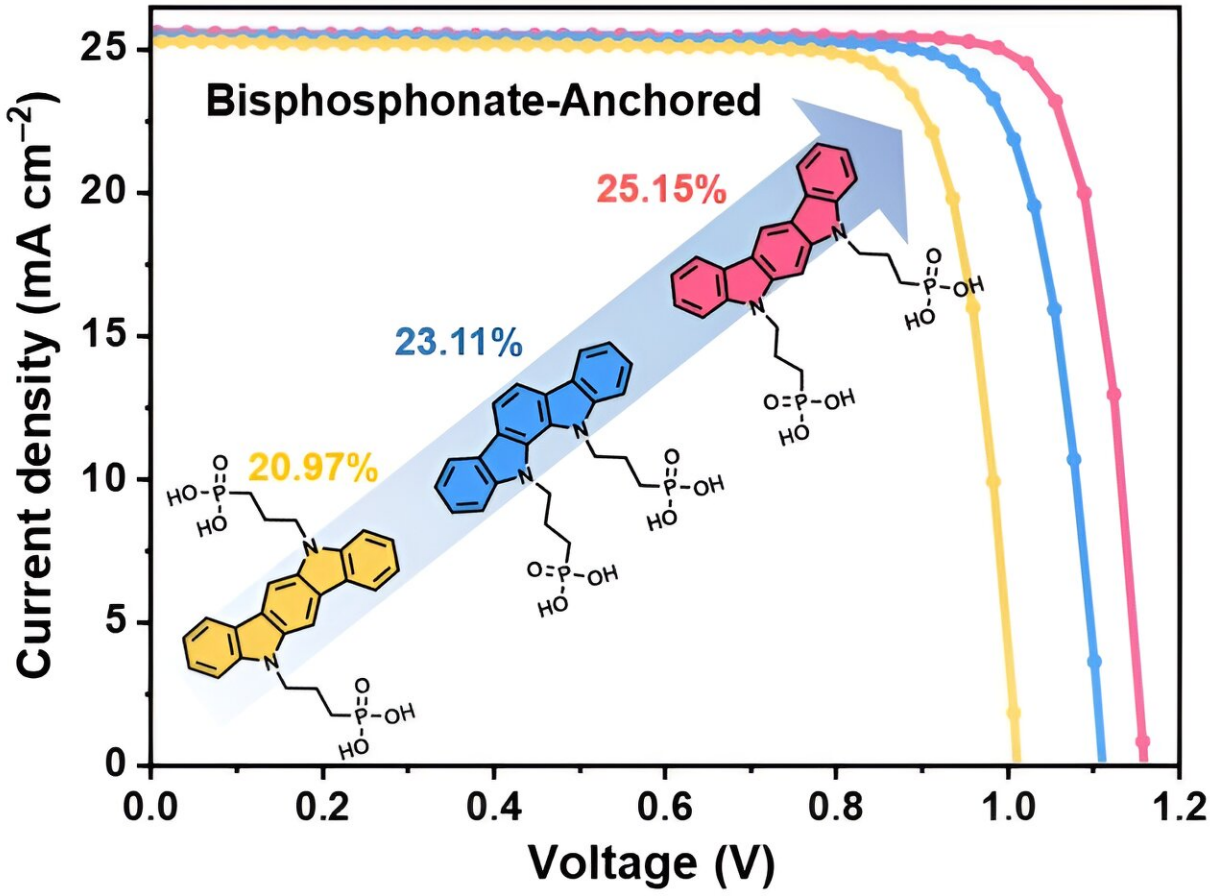

The high-performance inverted perovskite solar cells with bisphosphonate-anchored SAMs. Credit: NIMTE

A research group led by Prof. Ge Ziyi from the Ningbo Institute of

Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences has developed three isomeric bisphosphonate-anchored self-assembled molecules (SAMs) to achieve highly efficient and stable inverted perovskite solar cells (PSCs). The work was published in *Advanced Materials*.

Perovskite solar cells have attracted much attention as a promising green energy technology due to their low fabrication cost and extraordinary power conversion efficiencies (PCEs).

The wettability, absorbability and compactness of SAMs, which are used as hole-transporting layers (HTLs) for PSCs, critically affect the efficiency and stability of the devices. Therefore, the researchers proposed a molecular strategy to synthesize three bisphosphonate-anchored indolocarbazole (IDCz)-derived SAMs, namely IDCz-1, IDCz-2, and IDCz-3.

The three SAMs with different positions of the two nitrogen atoms in the IDCz unit were each employed on conductive oxide substrates for inverted PSCs.

Compared with IDCz-1 and IDCz-2, IDCz-3 exhibited larger dipole moment, higher energy level and larger water contact angles, which contributed to the hole extraction and electron blocking.

As a result, the inverted PSC with IDCz-3 as HTL achieved a record high PCE of 25.15%, which is the highest value reported to date for multipodal SAMs-based PSCs.

When stored in a nitrogen environment at room temperature for 1,800 hours, the IDCz-3-based device can almost maintain its initial efficiency, indicating its excellent long-term stability.

More information: Jie Wu et al, Bisphosphonate-Anchored Self-Assembled Molecules with Larger Dipole Moments for Efficient Inverted Perovskite Solar Cells with Excellent Stability, *Advanced Materials* (2024). DOI: 10.1002/adma.202401537

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