Self-Assembling Molecules Boost Perovskite Solar Cell Efficiency

A research group led by Prof. GE Ziyi at 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), making it possible to achieve high-efficiency and stable inverted perovskite solar cells (PSCs).

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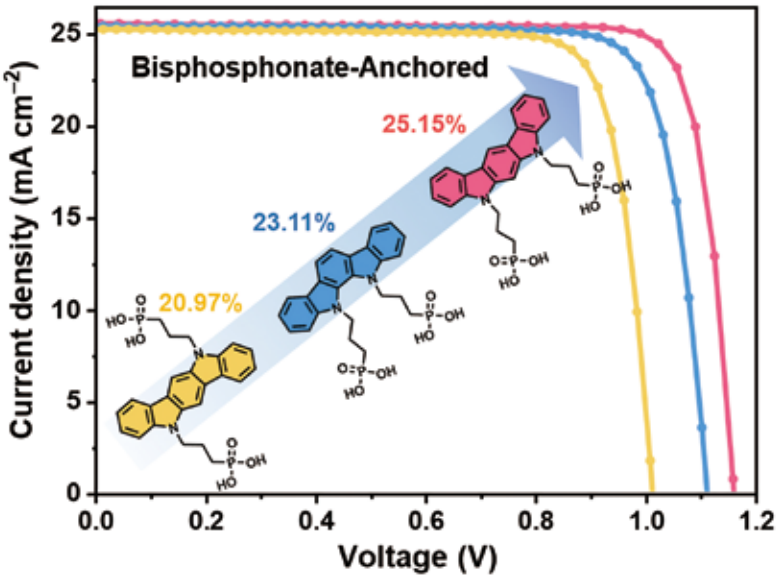
PSCs have attracted extensive attention as a promising green energy technology, owing to their low fabrication costs and extraordinary power conversion efficiencies (PCEs).

The wettability, adsorbability and compactness of SAMs, which are employed as hole-transporting layers (HTLs) for PSCs, exert critical influence on the efficiency and stability of the devices. Thus, researchers at NIMTE 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 employed on conductive oxide substrates for inverted PSCs respectively.

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

Consequently, the inverted PSC using 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.



Graphic: NIMTE

The high-performance inverted perovskite solar cells – power conversion efficiencies ranging from 20.97% to 25.15% – with bisphosphonate-anchored self-assembled molecules.

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

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(Source: NIMTE)