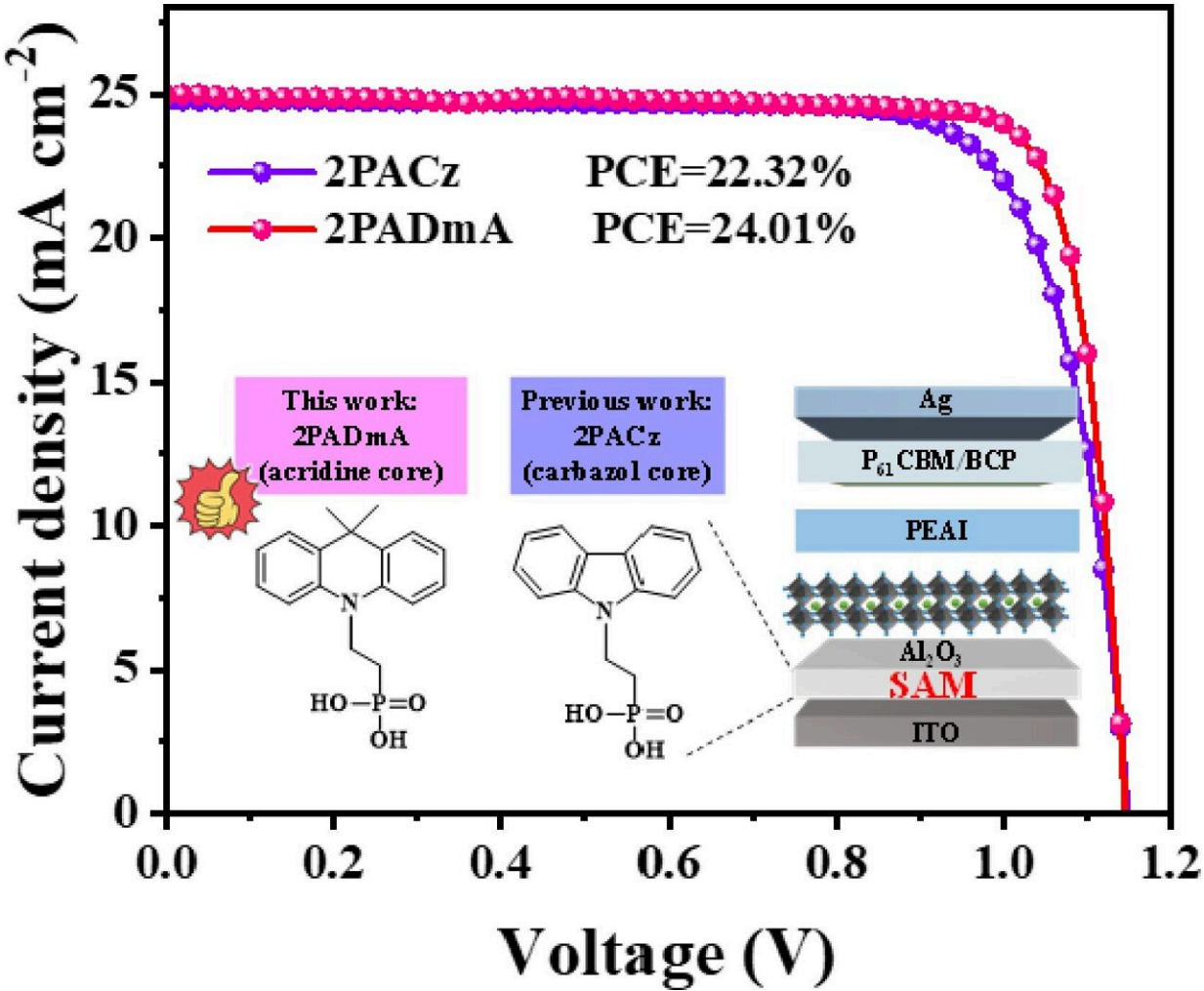


Unlocking new potential in solar tech: Dimethyl acridine enhances perovskite solar cells

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The current density-voltage (J-V) characteristics of inverted perovskite solar cells using two different self-assembled monolayers (SAMs) as hole transport

layers: 2PACz (carbazole core) and 2PADmA (acridine core). The 2PADmA-based device shows a higher power conversion efficiency (PCE) of 24.01%, compared to 22.32% for the 2PACz-based device. The structural schematic highlights the differences between the two SAM molecules and the layer structure of the solar cells. Credit: *Energy Materials and Devices*, Tsinghua University Press

Perovskite solar cells (PSCs) are highly regarded for their exceptional performance and straightforward fabrication. However, traditional hole transport layers (HTLs) like poly (triarylamine) (PTAA), nickel oxide (NiOx), and poly (3,4-ethylenedioxythiophene)-poly (styrenesulfonate) (PEDOT) have inherent limitations that impede efficiency and stability. These materials often suffer from issues such as hydrophobicity, high reactivity, and acidity, which negatively affect the overall performance of PSCs.

Due to these challenges, there is a pressing need to explore and develop novel HTLs that can overcome these limitations and further enhance the capabilities of PSCs.

A team of researchers from Yunnan University and the University of Science and Technology of China has designed and synthesized a new dimethyl acridine-based self-assembled monolayer (SAM), [2-(9,10-dihydro-9,9-dimethylacridine-10-yl)ethyl] phosphonic acid (2PADmA), for use as a hole transport layer in inverted PSCs. The study [is published](#) in *Energy Materials and Devices*.

The research team synthesized a novel dimethyl acridine-based SAM, 2PADmA, and employed it as a hole-transporting layer in inverted PSCs. This SAM modulates perovskite crystallization, enhances carrier transport, passivates defects, and reduces nonradiative recombination.

The 2PADmA-based devices achieved a [power conversion efficiency](#) (PCE) of 24.01%, significantly higher than the 22.32% PCE of devices using the commonly employed 2PACz SAM.

The increased performance is primarily due to an improved fill factor (FF) of 83.92% compared to 78.42% for the 2PACz-based devices. Additionally, the 2PADmA-based devices showed enhanced stability, retaining about 98% of their initial PCE after 1,080 hours of dark storage and 87% after 400 hours of heating at 85° C, demonstrating superior performance and durability.

Dr. Bing Cai, a researcher from Yunnan University, stated, "The development of the 2PADmA SAM represents a significant advancement in the field of PSCs. This novel SAM not only improves the efficiency and stability of PSCs but also offers a new approach to designing advanced HTLs for future solar cell technologies."

The innovative 2PADmA SAM opens up new possibilities for improving the efficiency and stability of PSCs, making them more viable for commercial applications. This advancement could lead to the development of more efficient and durable [solar energy systems](#), contributing to the global transition to renewable energy sources and supporting efforts to combat climate change.

More information: Liufei Li et al, Dimethyl acridine-based self-assembled monolayer as a hole transport layer for highly efficient inverted perovskite solar cells, *Energy Materials and Devices* (2024). [DOI: 10.26599/EMD.2024.9370038](https://doi.org/10.26599/EMD.2024.9370038)

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