Researchers develop stable and efficient inorganic CsPbI3 solar cells

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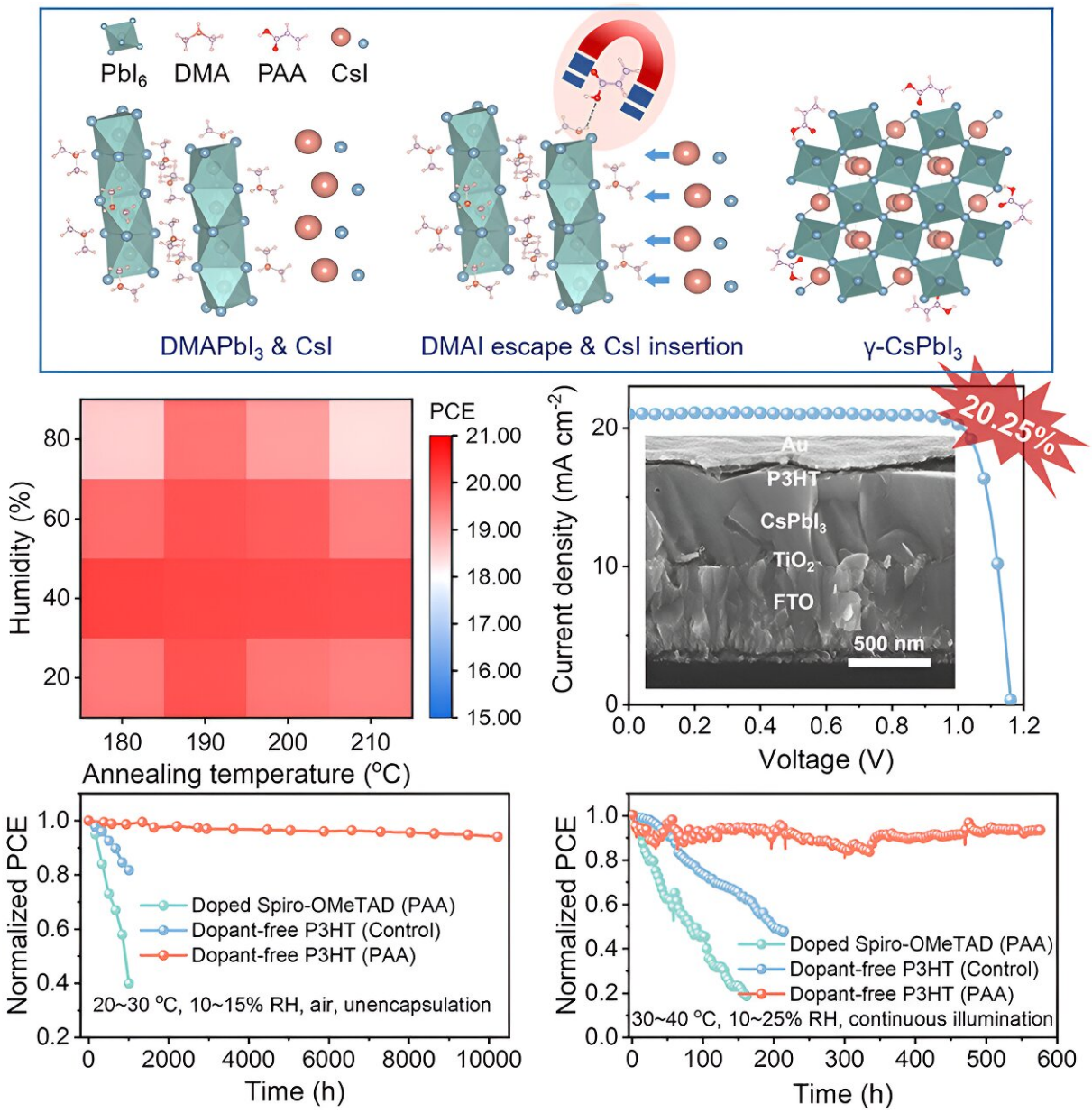

Credit: *Joule* (2023). DOI: 10.1016/j.joule.2023.09.009

The chemical and thermal stable inorganic cesium lead triiodide ($CsPbI_3$) perovskite has shown great potential for photovoltaic applications. $DMAPbI_3$ (dimethylammonium [DMA]) or "$HPbI_3$"-assisted crystallization is effective for the preparation of high-quality β- or γ-phase $CsPbI_3$ films, but it unfortunately causes $DMAPbI_3$ residue and the degradation of photovoltaic performance and stability.

In a recent study published in *Joule*, the research group led by Prof. Hu Jinsong from the Institute of Chemistry of the Chinese Academy of Sciences (ICCAS) developed a universal hydrogen-bonding-facilitated DMA extraction strategy for fabricating efficient and stable inorganic $CsPbI_3$ solar cells.

The researchers introduced polyacrylic acid (PAA) into the inorganic $CsPbI_3$ precursors consisting of CsI, PbI_2 and DMAI. During the formation of $CsPbI_3$ the PAA could form the hydrogen bonds with DMA, which accelerates the decomposition of $DMAPbI_3$ and DMA extraction. The PAA-added sample exhibited relatively faster phase transformation and achieved the high-quality $CsPbI_3$ film with no DMA residue. Systematic experimental and theoretical investigations revealed that the hydrogen bonding facilitated the DMA extraction by lowering the its escaping energy barrier.

The strategy is also applicable to other additives which can form hydrogen bonding with DMA such as polyacrylonitrile (PAN) or poly(4-vinylpyridine) (PVP).

Combining with stable poly(3-hexylthiophene) (P3HT) hole transport layers, the $CsPbI_3$ perovskite solar cells (PSCs) with PAA treatment

achieved a power conversion efficiency (PCE) of 20.25%, the highest efficiency reported on $CsPbI_3$ PSCs with a dopant-free P3HT hole transport layer (HTL). The devices demonstrated superior moisture and operational stability in terms of maintaining 94% of their initial PCE after aging at low relative humidity (RH) conditions (