Supramolecular Engineering of Layered Architectures for Perovskite Solar Cells

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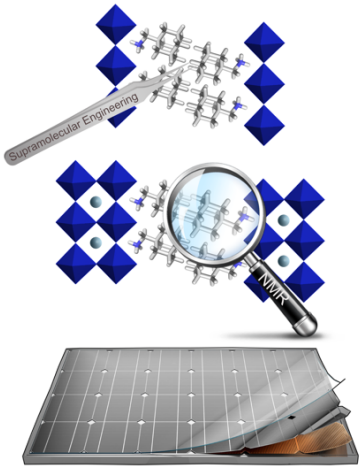
Hybrid perovskite solar cells exhibit remarkable solar-to-electric power conversion efficiencies, however, their limited stability and molecular-level engineering remain challenging.[1-5] In contrast to three-dimensional perovskites, their layered low-dimensional analogs have demonstrated superior stabilities, though at the expense of the corresponding efficiencies.[1,4-5] We demonstrate a strategy to provide stabilization without compromising the performance by employing multifunctional molecular modulators that are designed by fine-tuning noncovalent interactions complemented by structural adaptability.[2-5] These systems are devised to interact with the hybrid perovskites in a manner uniquely assessed at the atomic level by solid-state NMR spectroscopy.[2-3] As a result, we obtain perovskite solar cells with superior properties and high power conversion efficiencies, accompanied by enhanced operational stabilities.[3] Moreover, extending the design into low-dimensional architectures provides further stability enhancements.[4-5] This approach has been investigated using a combination of techniques complemented by solid-state NMR to unravel the design principles and exemplify the role of supramolecular engineering in advancing perovskite research.



Schematic representation of a layered perovskite prototype structure

Reference

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