

Semiconductor Nanomaterials for Photoelectrochemical Energy Conversion

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Semiconductor nanomaterials hold the keys for efficient solar energy harvesting and conversion processes like photocatalysis and photoelectrochemical reactions. In this talk, we will give a brief overview of our recent progress in designing semiconductor nanomaterials for photoelectrochemical energy conversion including solar hydrogen generation and low-cost solar cells. In more details, we have been focusing on a few aspects; 1) photocatalysis mechanism, light harvesting, charge transfer and surface reaction engineering of low-cost metal oxide-based semiconductors as efficient photoelectrode for photoelectrochemical hydrogen production; 2) the working mechanism and stability improvement of perovskite quantum dots and lead-free tin-based perovskite solar cells; 3). The design of ultra-stable composites of perovskite-MOF with improved light emitting performance and photocatalysis.¹⁻⁷ The resultant material systems exhibited efficient photocatalytic performance and improved power conversion efficiency in solar cells, which underpin sustainable development of solar-energy conversion application.

References :

- [1] Nature Energy, 2020, 5, 79-88.
- [2] Adv. Mater., 2022, 34 (10), 2106776.
- [3] Science, 2021, 374, 621.
- [4] Nature Commun, 2023, articles/s41467-023-35830-8
- [5] Nature Commun, 2024, articles/s41467-024-53426-8
- [6] J. Am. Soc. Soc, 2025, 147, 3195.
- [7] Nature Nanotech, 2025, 20, 799.