All-Perovskite Photoelectrochemical Cell for Artificial Photosynthesis of Solar Hydrogen

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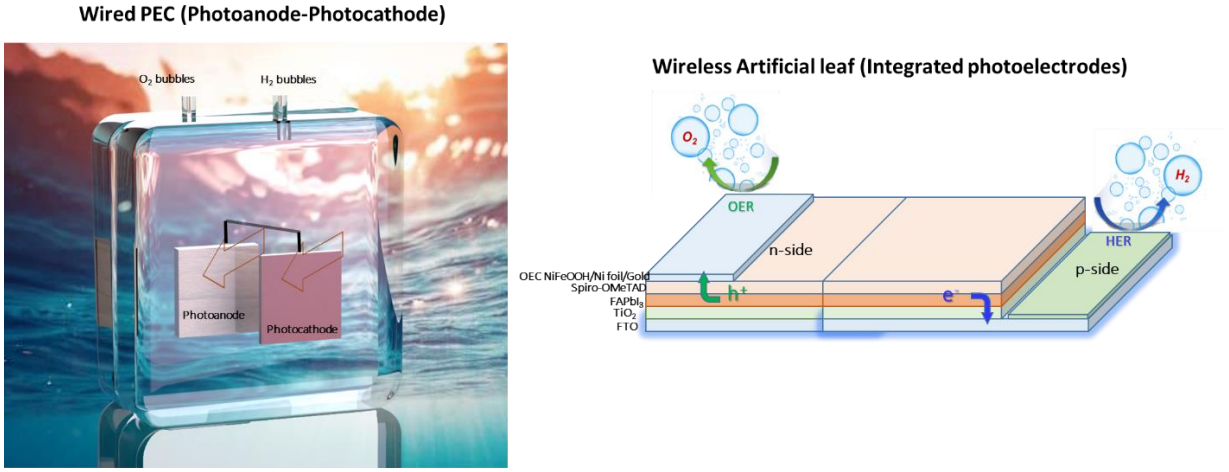
Abstract
Perovskite photoelectrodes are promising for efficient photoelectrochemical (PEC) overall water splitting (OWS) due to its photocurrent, photovoltage and early onset potential [1, 2]. However, activating their photostability in electrolyte is tough, yet this has proven challenging because degradation performance of perovskite photoanode and photocathode in different electrolyte [3, 4]. Here, we report the first use of pure $FAPbI_3$ thin-film with above requirements by flipping n-i-p structure for development of integrated photocathode, which displays photoelectrochemically efficient performance with photocurrent density of -19 mA cm^{-2} at 0 *V vs.* RHE and alkaline stable for > 15 hours with enough O_2-H_2 gas productivity. Integrated $FAPbI_3$/HEC photocathode show positive onset potential of 1.1 *V* vs. RHE, which allows to combine with water oxidating and alkaline stable $FAPbI_3$/OEC photoanode (21 mA cm^{-2} at 1.23 *V vs.* RHE) for the development of all-perovskite dual configurations in transparent archetype conjoined PEC cell. This unassisted photonic OWS system using parallelly "wired" configuration shows a maximum solar-to-hydrogen (STH) conversion efficiency of >5% with photostability of > 10 hours, while its arising "wireless" standalone artificial leaf shows the STH conversion efficiency of 4.1% with 3 hours of photostability in fully-alkaline media.



Keywords: $FAPbI_3$; Photoelectrodes; Water splitting, PEC cells; Solar H_2

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