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Supplementary Materials: High Performance of Manganese Porphyrin Sensitized p-Type $CuFe_2O_4$ Photocathode for Solar Water Splitting to Produce Hydrogen in a Tandem Photoelectrochemical Cell

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2. Results

2.1. Morphology and Structure

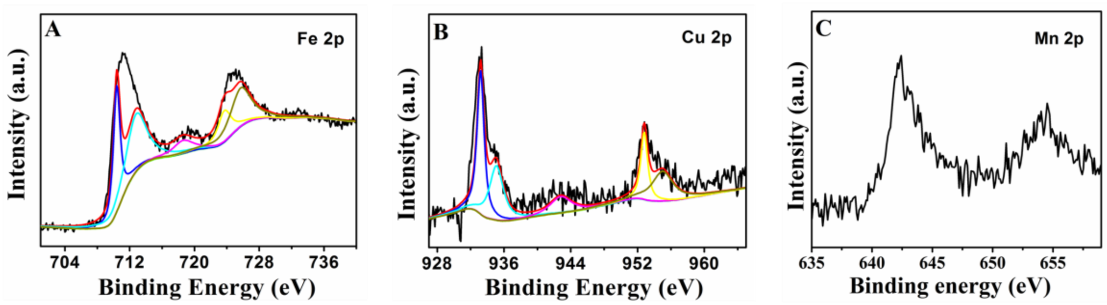


Figure S1. High-resolution XPS spectra of **A**) Fe 2p and **B**) Cu 2p of $CuFe_2O_4$ nanospheres; **C**) Mn 2p from MnTPP/$CuFe_2O_4$ hybrid.

2.3. Photocatalytic Activity

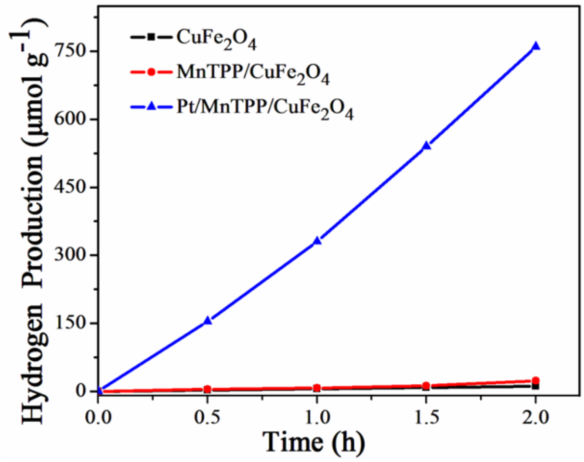


Figure. S2. Amount of hydrogen evolved from the PEC device with $CuFe_2O_4$, MnTPP/$CuFe_2O_4$ and Pt/MnTPP/$CuFe_2O_4$ at -0.2 V applied bias vs. RHE. Reaction conditions: electrolyte 0.2 M phosphate buffer solution. Light intensity 16 mW cm^2.

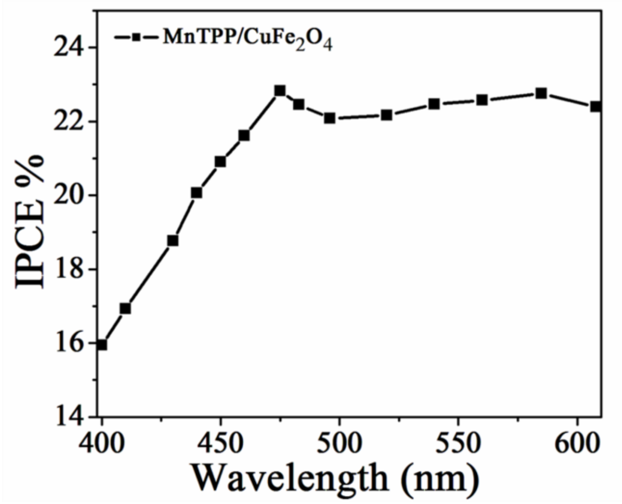


Figure S3. IPCE spectra of the PECs in 0.2 M phosphate buffer solution without any bias voltage.

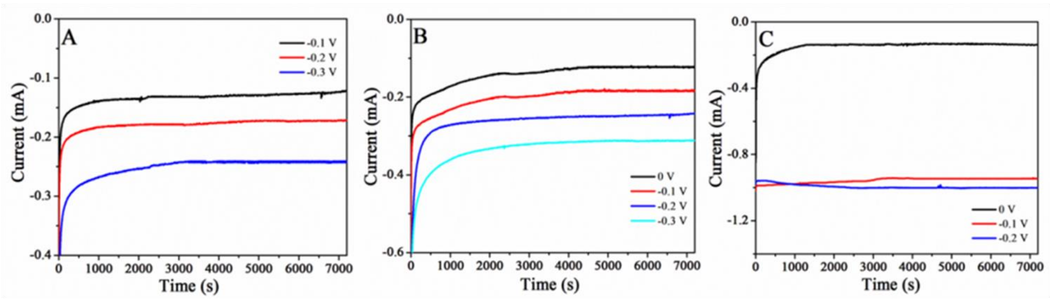
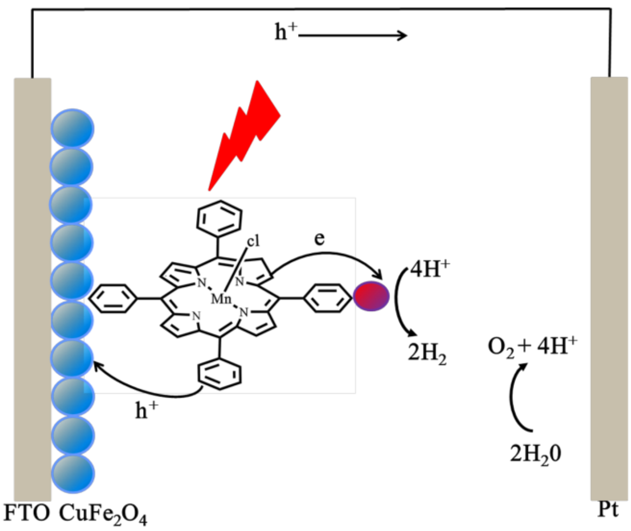


Figure S4. Current density vs time behavior from the PEC device with (A) $CuFe_2O_4$, (B) MnTPP/$CuFe_2O_4$ and (C) Pt/MnTPP/$CuFe_2O_4$ as the photocathode at different applied voltages vs. RHE. Reaction conditions: electrolyte 0.2 M phosphate buffer solution. Light intensity 16 mW cm[2].



Scheme 1. Scheme of three-electrode PEC device.

Table S1. Comparison of the performance of photocathodes

photocathode	E/V	n/H_2	Electrolyte condition	Light source	Ref
ZnPc/C_{60}/Pt	0.2 V vs. RHE	110 μL	H_3PO_4 solution (pH 2)	90 mW cm^{-2}	[1]
Pt/TiO_2/N, Zn-Fe_2O_3/Cr_2O_3	0.1 V vs. RHE	11 μmol cm^{-2}	0.5 M Na_2CO_3-$NaHCO_3$ (1:1) buffer electrolyte (pH 9.7)	300 W Xenon lamp	[2]
TiO_2/$CaFe_2O_4$/Pt	1.2 V vs.RHE	1.8 μmol	0.1 M NaOH	A solar simulator (400 mW cm^{-2})	[3]
Pt/In_2S_3/CdS/CZTS	0.5 V vs. RHE	9.5 μmol	0.2 M Na_2HPO_4/NaH_2PO_4 (pH 6.5)	AM 1.5G light irradiation	[4]
N-Ta_2O_5/Pt	-0.4 V vs. Ag/AgCl	0.58 μmol cm^{-2}	0.2 M K_2SO_4	A 500 W Xeon lamp	[5]
$CuFe_2O_4$/MnTPP/Pt	-0.2 V vs.RHE	760 μmol g^{-1}	0.2 M phosphate buffer solution (pH 7)	A 300 W solar simulator	This work

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