

Supporting Information

**Enhancing light harvesting and charge separation of Cu₂O
photocathodes with spatially separated noble-metal cocatalysts
towards highly efficient water splitting**

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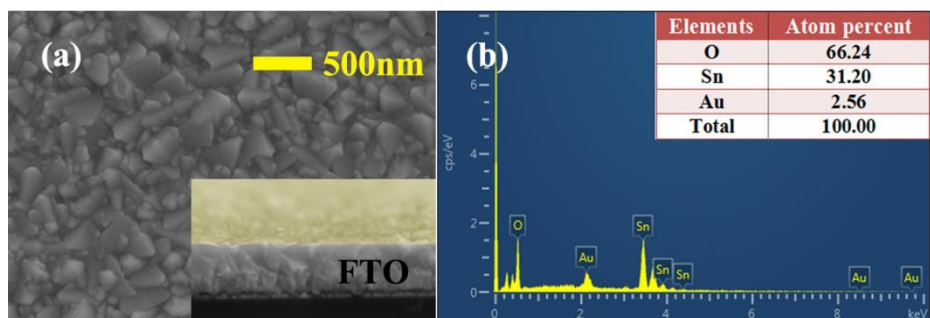


Fig. S1 (a) Top-view and cross-section SEM image and (b) the EDS elemental analysis spectrum of Au

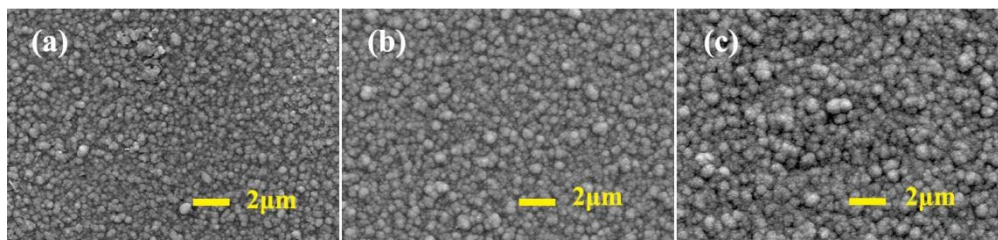


Fig. S2 SEM images of Cu_2O prepared by varied electrodeposition time: (a) 5min, (b) 15 min, (c) 30 min

Fig. S3 Photocurrent density-voltage curves of bare Cu₂O with different (a) electrodeposition time and (b) concentration of precursor solution for CuSO₄

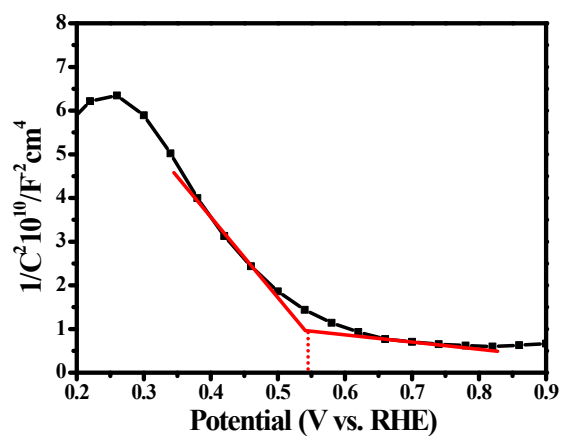


Fig. S4 Mott-Schottky plot of Cu₂O measured in 0.1 M Na₂SO₄ solution at
1 kHz

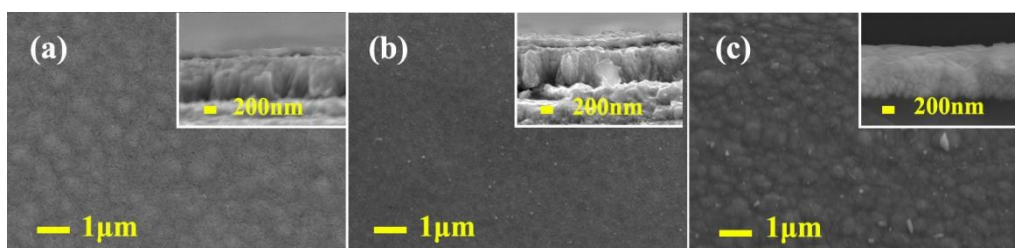


Fig. S5 Top-view and cross-section SEM images of $\text{Cu}_2\text{O}/\text{Pt}$ photocathodes prepared by different deposition time: (a) 90 s, (b) 120 s, (c) 180 s

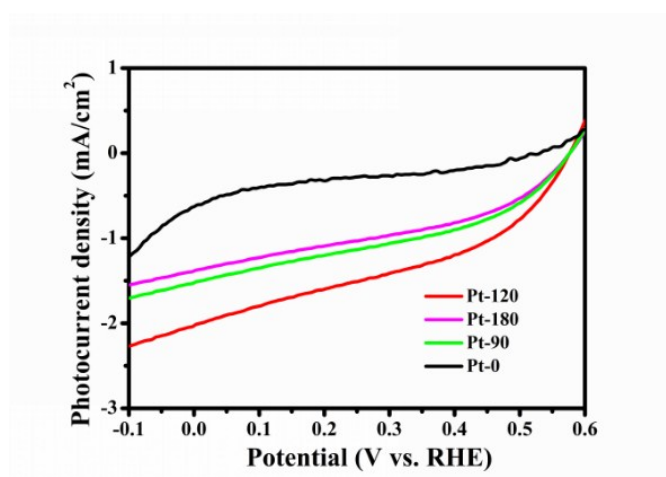


Fig. S6 Photocurrent density-voltage curves of $\text{Cu}_2\text{O}/\text{Pt-x}$ photocathodes in 5 mM H_2PtCl_6 aqueous solutions for various times. Pt-0: reference Cu_2O NGs, Pt-90: 90 s; Pt-120: 120 s; Pt-180: 180 s

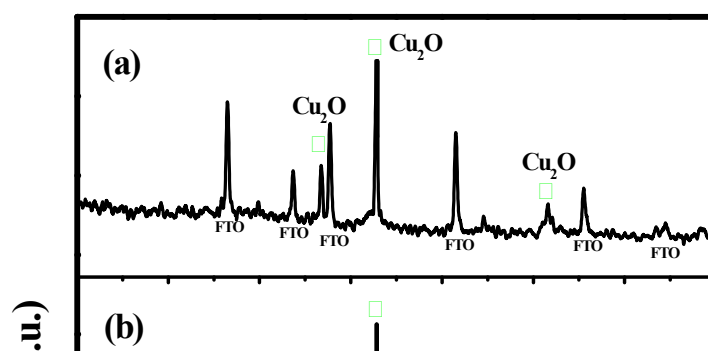


Fig. S7 XRD (a) before and (b) after PEC stability measurement for the pristine Cu_2O and (c) after PEC stability measurement for Au/ Cu_2O /Pt composite

Fig. S8 Cyclic voltammetry of (a) pristine Cu_2O and (b) $\text{Au/Cu}_2\text{O/Pt}$ composite

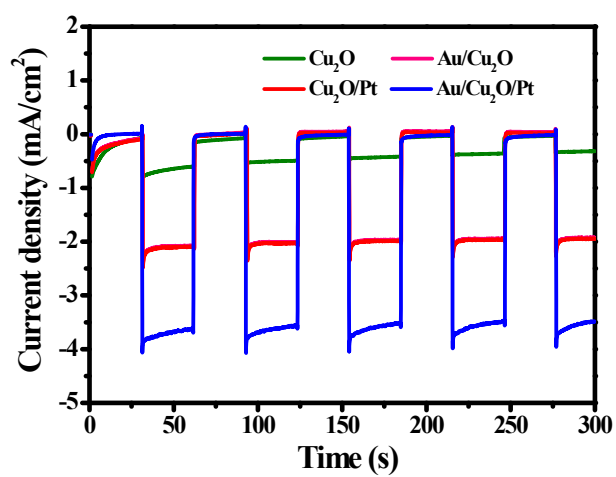


Fig. S9 Photocurrent density-time characteristics in 0.1 M Na_2SO_4 solution for pristine Cu_2O , $\text{Cu}_2\text{O/Pt}$, $\text{Au/Cu}_2\text{O}$ and $\text{Au/Cu}_2\text{O/Pt}$ electrodes at 0 V vs. RHE

Table S1 EIS fitting results of R_{ct} for Cu₂O NGs, Au/Cu₂O, Cu₂O/Pt and Au/Cu₂O/Pt photocathodes as shown in Fig. 9

Sample	Cu ₂ O	Au/Cu ₂ O	Cu ₂ O/Pt	Au/Cu ₂ O/Pt
R_{ct} (Ω)	1546	1318	453	250