Supplementary Information

Designed formation of Cu_2S hierarchical nanostructures as self-supported photoelectrodes for photo-supercapacitors

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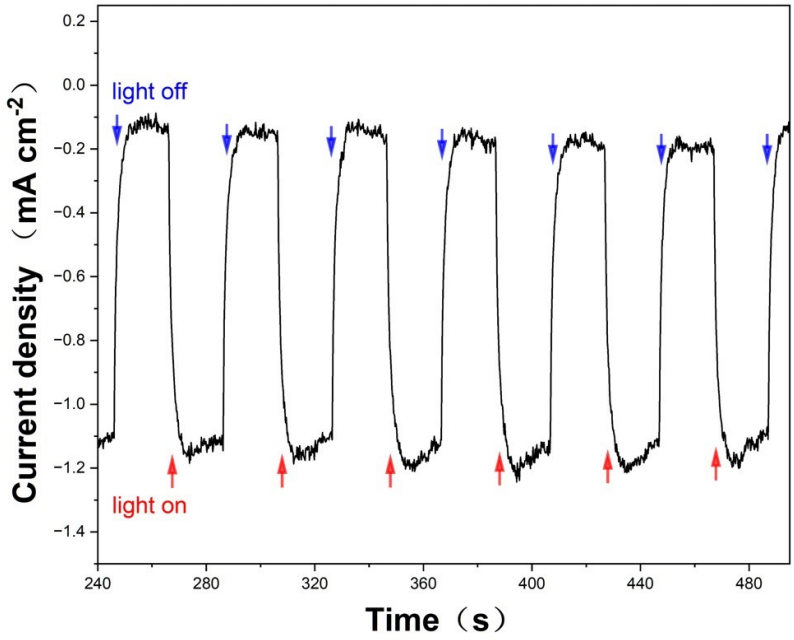

Fig. S1. The photocurrent response of the CF@Cu_2S-100 sample was obtained with a time interval of 20 s.

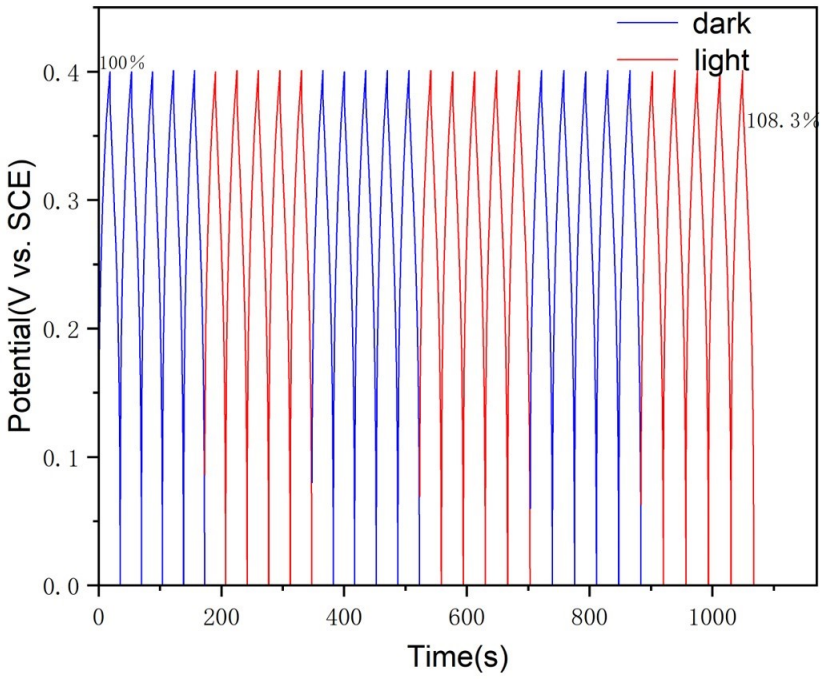

Fig. S2. The GCD curves were obtained at 20 mA cm^{-2} under a switched light on/off mode for the CF@Cu_2S-100 sample.

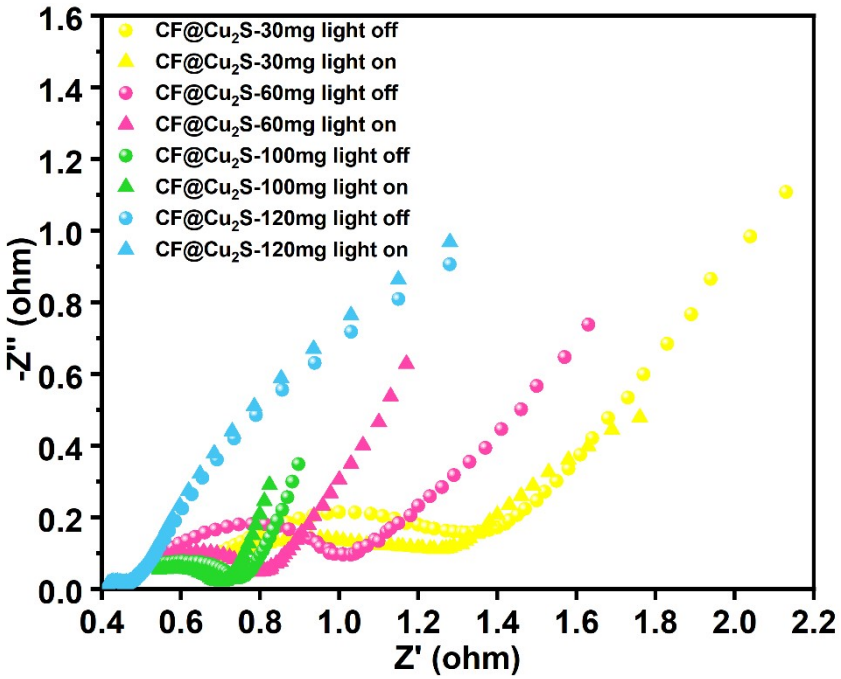

Fig. S3. EIS plots of CF@Cu_2S electrodes.

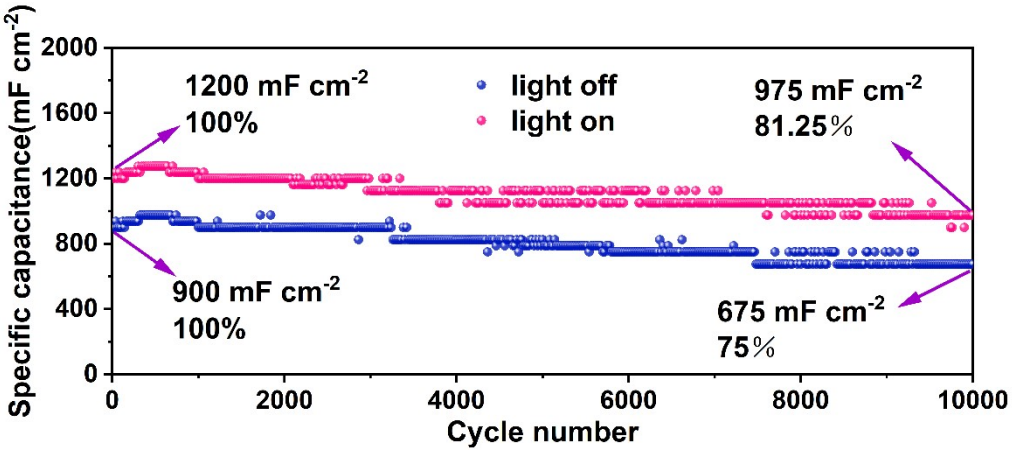

Fig. S4. Cycling performances under light off and on conditions of the CF@Cu_2S-100 sample at a current density of 30 mA cm^{-2} using a light source with a single wavelength of 365 nm.

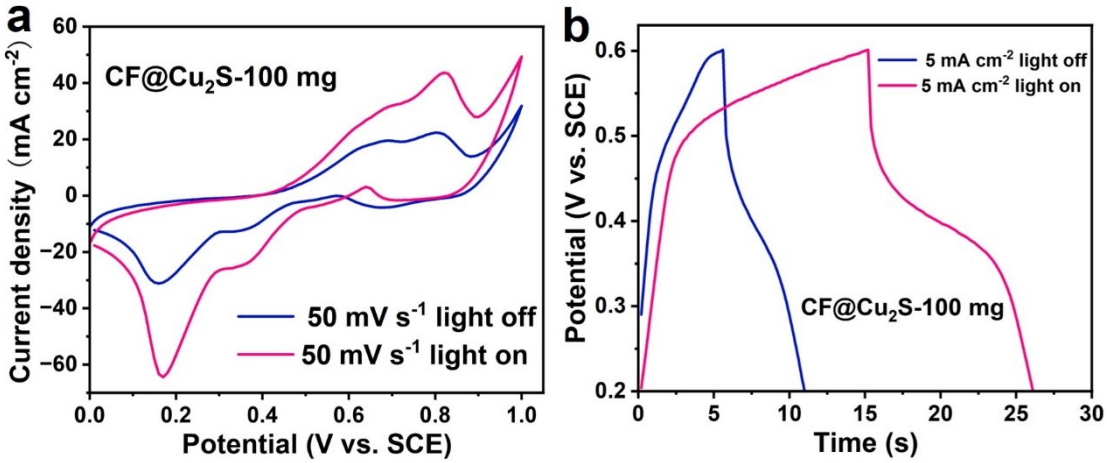

Fig. S5. (a) CV and (b) GCCD curves obtained under light on and off conditions, respectively, of the CF@Cu_2S-100 sample.

Table S1. A comparison of the electrochemical performance of CF@Cu_2S-100 with various PSC composites has been previously reported.

PSC devices	Capacitance (dark)	Capacitance (Light)	References
CL@SnS/NF	15.7 mF cm^{-2}	21.0 mF cm^{-2}	[1]
CoCN-0.55	943.8 mF cm^{-2}	1088.0 mF cm^{-2}	[2]
Cu_2O/Fe_2O_3	507 F g^{-1}	595 F g^{-1}	[3]
BVO-V_2O_5@TiNT	100 mF cm^{-2}	288 mF cm^{-2}	[4]
$NiCo_2S_4$@Cu_2O@CF	733.3 mF cm^{-2}	1156.7 mF cm^{-2}	[5]
CF@Cu_2S-100	**918 mF cm^{-2}**	**1458 mF cm^{-2}**	**This work**

References:

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2. Bai, L., et al., *Photocatalysis-assisted Co_3O_4/g-C_3N_4 p–n junction all-solid-state supercapacitors: a bridge between energy storage and photocatalysis.* Advanced science, 2020. **7**(22): p. 2001939.
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promote photocatalytic CO_2 reduction and photo-assisted charge storage. Sustainable Energy & Fuels, 2024. **8**(21): p. 4992-5000.

4. Renani, A.S., et al., *New photoelectrodes based on bismuth vanadate-V_2O_5@ TiNT for photo-rechargeable supercapacitors.* Journal of Energy Storage, 2023. **62**: p. 106866.
5. Arif, M., et al., *Construction of three-dimensional $NiCo_2S_4$@Cu_2O nanowires with a high surface photovoltage to promote the energy efficiency of photo-assisted supercapacitors.* Journal of Colloid and Interface Science, 2025: p. 138067.