Supplementary Information

Copper Sulfide Based Self-powered Photoelectrochemical Detectors for Optical Communication in Seawater

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Supplementary Figures

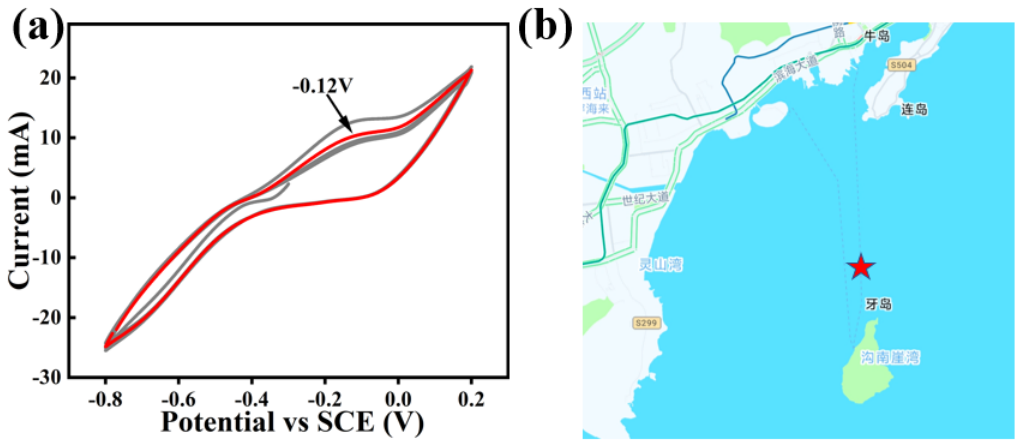


Fig. S1. (a) CV plot for CuS film deposition, (b) sampling sites of seawater.

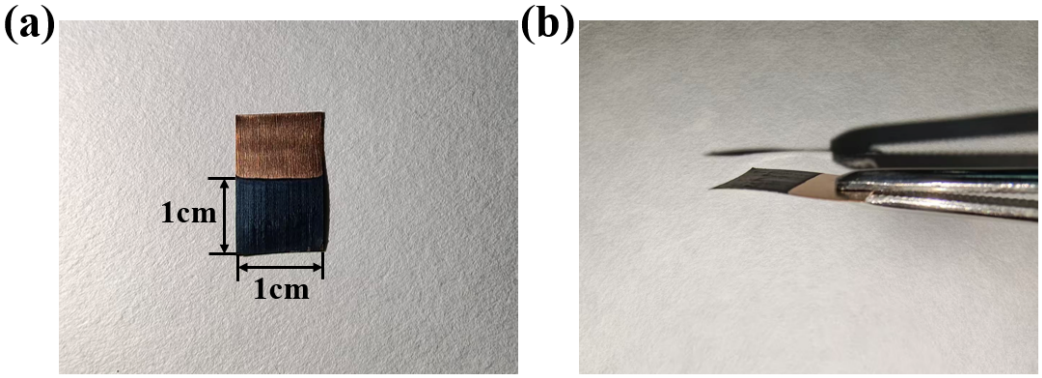


Fig. S2 (a)Front and (b) side view photographs of the CuS PEC detector.

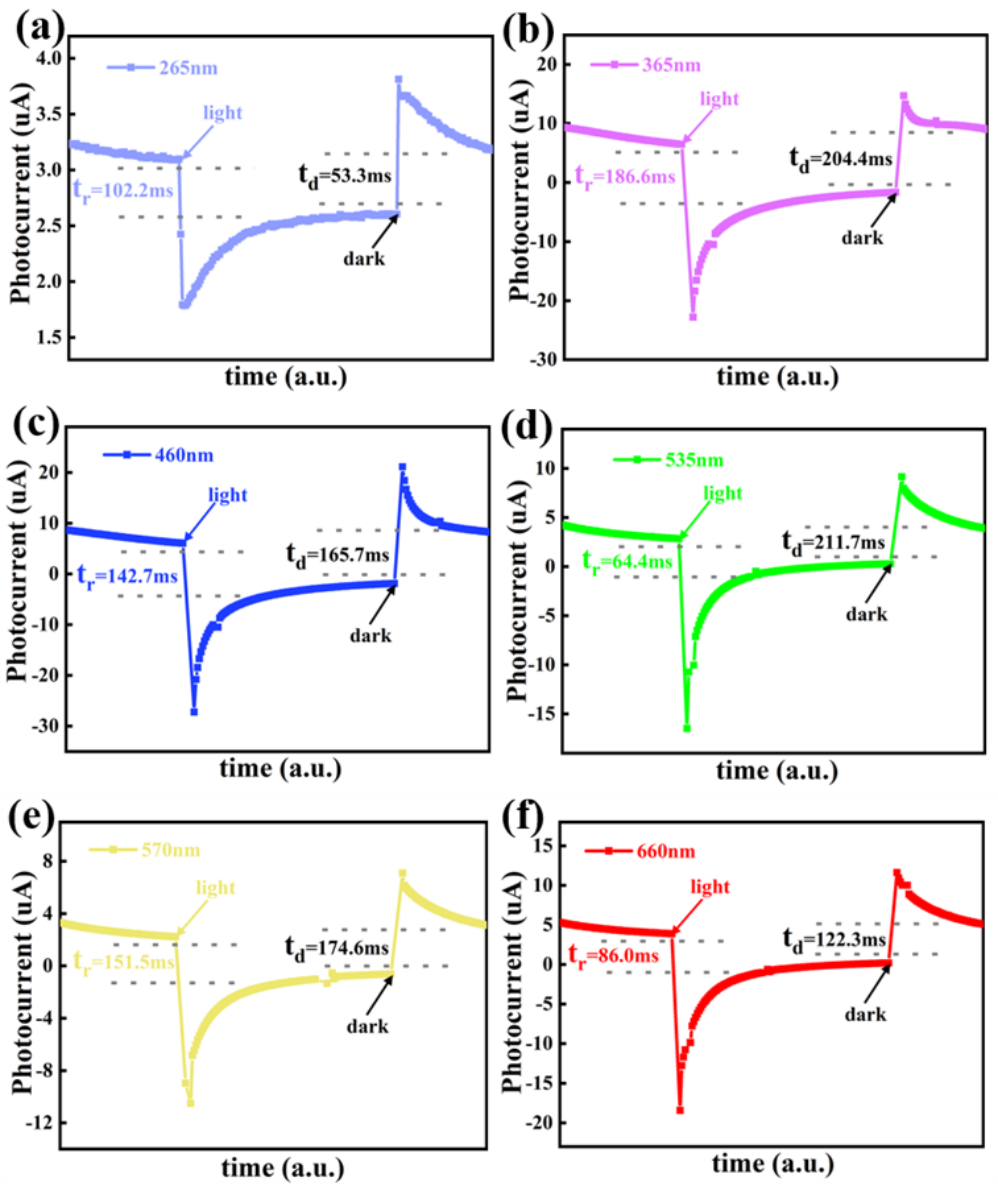
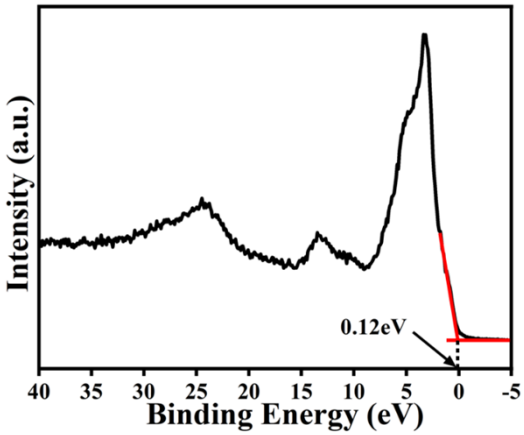


Fig. S3 Response time of the CuS PEC detector under illumination at wavelengths of (a) 265 nm, (b)



365 nm, (c) 460 nm, (d) 535 nm, (e) 570 nm, and (f) 660 nm.

Fig. S4 XPS valence band spectrum of CuS.

Supplementary Tables

Table S1 Performance comparison of PEC detectors based on transition metal chalcogenides

Materials	Electrolyte	Responsivity (μA/W)	Response Time (ms)	Reference
CuO	0.1 M Na_2SO_4, -0.4V	2700	60/400	[1]
SnS	0.5 M Na_2SO_4, 0.6V	59.8	200/400	[2]
Bi_2S_3	1.0 M KOH, 0.6 V	210	100/100	[3]
PbS	0.05 M KOH, 0.4 V	28810	160/160	[4]
GeSe	0.5 M KOH, 0.3V	76.3	200/200	[5]
GeTe	0.3 M Na_2SO_4, 0.6V	228.9	690/880	[6]
CuS	Seawater, 0V	2730	119/142	this work

Table S2 Performance comparison of PEC detectors in seawater and simulated seawater environments

Materials	Electrolyte	Responsivity (μA/W)	Response Time (ms)	Reference
$SnSe_2$	Seawater, 0V	505.74	45/20	[7]
$SnSe_2$	Seawater, 0.4V	10342	90/180	[7]
ZnO	Seawater, 0V	2040	120.7/127	[8]
CuSe	simulated seawater, 0V	408.7	<200	[9]
CuSe	simulated seawater, -0.3V	9500	20/17	[9]
InSe	simulated seawater, 0V	800	28/300	[10]
CuS	Seawater, 0V	2730	119/142	this work

Table S3 Performance comparison of self-powered PEC detectors

Materials	Electrolyte	Responsivity (μA/W)	Response Time (ms)	Reference
ZnO	0.1 M Na_2SO_4	379.9	152/151	[11]
$SnSe_2$	0.5 M Na_2SO_4	1.359	400/800	[12]
Bi_2S_3	0.1 M KOH	8.9	100/100	[2]
$TaSe_2$	0.5 M KOH	208	300/700	[13]
In_2Se_3	0.4 M KOH	1880	1/2	[14]
α-Ga_2O_3	0.5 M Na_2SO_4	3870	230/150	[15]
Bi_2O_2Se	1.0 M KOH	260	100/140	[16]
CuS	Seawater, 0V	2730	119/142	this work

Table S4 Stability comparison of PEC detectors

Materials	Stability test methods	Performance Retention (%)	Reference
In_2Se_3	100 cycles, 0V, 365nm, Seawater	95.8	[14]
$SnSe_2$	105 cycles, 0V, 405nm, Seawater	negligible change	[7]
ZnO	100 cycles, 0V, 365nm, Seawater	92.9	[8]
CuSe	400 cycles, -0.3V, 455nm, simulated seawater	78	[9]
InSe	vacuum storage tank, 10 months, 0V, 525 nm, simulated seawater	80	[10]
Bi_2S_3	ambient air storage, 1 month, 0V, simulated light, 0.1 M KOH	85.4	[3]
CuS	ambient air storage, 3 month, 0V, 420nm, Seawater	89.4	this work
CuS	300 cycles, 0V, 420nm, Seawater	81.1	this work

References

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