Supporting Information

Cobalt disulfide/graphite foam composite film as a self-standing electrocatalytic electrode for overall water splitting

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Supplementary Tables

Table S1 XPS results of CoS_2/GF electrode

Element	Atomic %
Co	11.50%
S	25.28%
C	50.56%
O	12.65%

Table S2 Electrical conductivity of GFL, CoS_2/GFL, OGF, and CoS_2/GF electrodes

Sample	Electrical conductivity (S cm^{-1})
GFL	1173
CoS_2/GFL	823
OGF	379
CoS_2/GF	236

Table S3 Comparison of the HER performance of CoS_2/GF in 0.5 M H_2SO_4 with those of reported high-efficient non-noble metal sulfide- or selenide-based HER electrocatalysts

Catalyst	Current density (mA cm^{-2})	Overpotential (mV)	Reference
CoS_2/GF	20	144	This work
CoS_2 nanosheets/RGO-CNT	20	153	S1
CoS_2 thin film	10	192	S2
MoS_2/RGO	20	140	S3
$CoSe_2$-BSND	20	125	S4
MoS_2 nanosheets	10	190	S5
$CoSe_2$ nanoparticles on carbon fiber	10	137	S6
$CoSe_2$ nanoparticles on Ti foil	10	135	S7
$CoSe_2$ nanoparticles on graphite disk	10	193	S7
p-T1-MoS_2	10	153	S8

Table S4 Comparison of the HER performance of CoS_2/GF in 1.0 M KOH with those of reported high-efficient non-noble metal sulfide- or selenide-based HER electrocatalysts

Catalyst	Current density (mA cm^{-2})	Overpotential (mV)	Reference
CoS_2/GF	20	224	This work
15-h CoS_2	10	244	S9
Ni_3S_2 Nanosheets array/Ni foam	10	170	S10
Ni_3S_2 Nanorod Array/Ni foam	10	200	S11
EG/$Co_{0.85}$Se/NiFe-LDH	10	260	S12
ECA CoMn-S@NiO/CC	100	232	S13

Table S5 Comparison of the OER performance of CoS_2/GF in 1.0 M KOH with those of reported high-efficient non-noble metal sulfide- or selenide-based OER electrocatalysts

Catalyst	Current density (mA cm^{-2})	Overpotential (mV)	Reference
CoS_2/GF	20	298	This work
Co_9S_8@MoS_2/carbon nanofibers	10	430	S14
Co_3O_4 Nanoflakes	10	380	S15
ALD NiS_x	10	353	S16
NiS@SLS	10	294	S17

Table S6 The normalized performance of CoS_2/GF and CoS_2/GFL for HER and OER according to the mass of electrocatalysts

Sample	$i_{m\,(188\ mV)}$ (mA mg^{-1}) HER (0.5 M H_2SO_4)	$i_{m\,(329\ mV)}$ (mA mg^{-1}) HER (1.0 M KOH)	$i_{m\,(1.571\ V)}$ (mA mg^{-1}) OER (1.0 M KOH)
CoS_2/GF	27.6	42.4	24.7
CoS_2/GFL	12.5	12.5	12.7

Table S7 Comparison of the performance of CoS_2/GF in 1.0 M KOH for whole water splitting with those of reported high-efficient non-noble metal sulfide- or selenide-based electrocatalysts

Catalyst	Current density (mA cm^{-2})	Overpotential (mV)	Reference
CoS_2/GF	20	1.74	This work
$Ni_{0.33}Co_{0.67}S_2$||$NiCoO_4$	10	~1.73	S18
CP/CTs/Co-S	10	1.743	S19
EG/$Co_{0.85}$Se/NiFe-LDH	20	1.71	S8
$NiCo_2S_4$ nanowires array	10	1.68	S20
NiSe Nanowire/ Nickel Foam	10	1.63	S21

Supplementary Figures

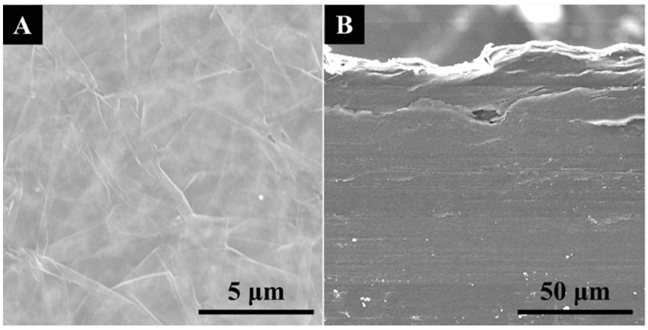

Fig. S1 (A) Top-view and (B) cross-sectional SEM images of GFL.

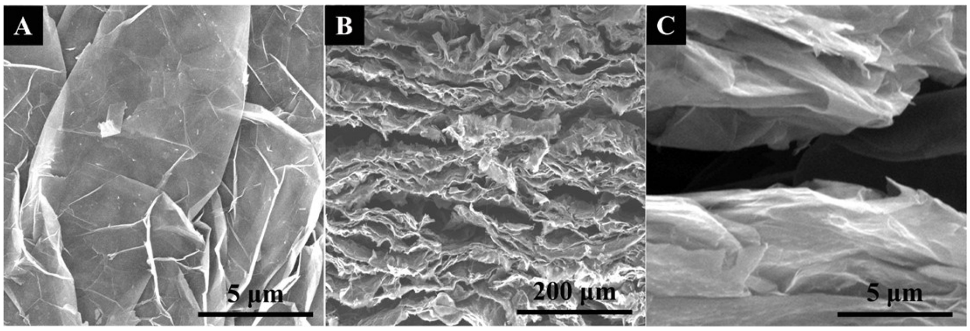

Fig. S2 (A) Top-view and (B-C) cross-sectional SEM images of OGF with different magnifications.

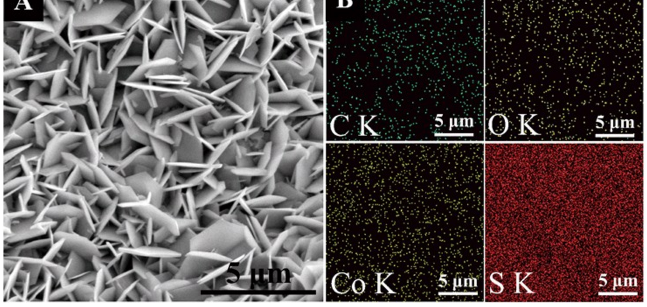

Fig. S3 (A) Top-view SEM image of CoS_2/GF and (B) EDS mapping images of (A) C, O, Co, and S elements in CoS_2/GF corresponding to panel A.

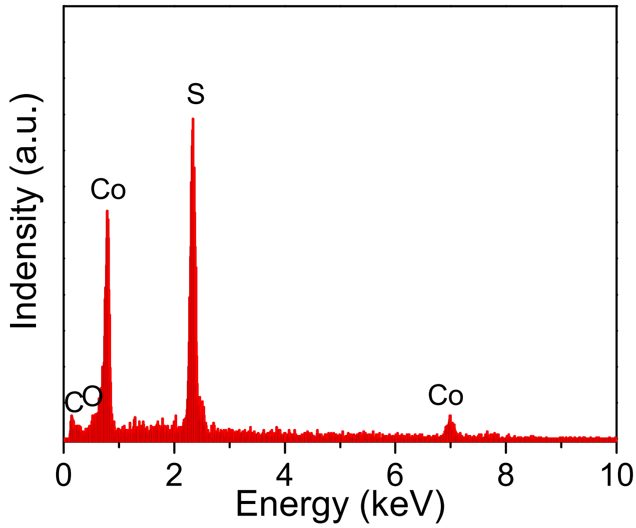

Fig. S4 EDS spectrum of CoS_2/GF.

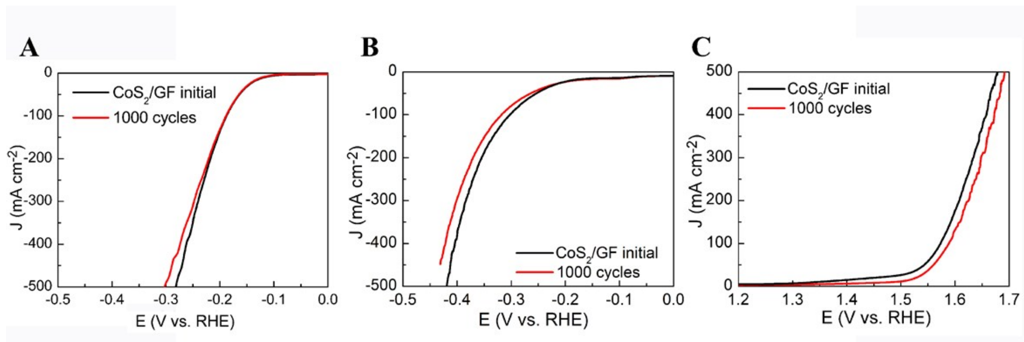

Fig. S5 (A, B) Polarization curves of CoS_2/GF before and after 1,000 CV cycles at a scan rate of 100 mV s^{-1} between 0 and –0.5 V vs. RHE for HER in 0.5 M H_2SO_4 (A) and 1.0 M KOH (B). (C) Polarization curves of CoS_2/GF before and after 1,000 CV cycles at a scan rate of 100 mV s^{-1} between +1.2 and +1.7 V vs. RHE for OER in 1.0 M KOH.

Fig. S6 Photograph showing the generation of hydrogen and oxygen bubbles from overall water splitting on CoS_2/GF electrodes in a two-electrode configuration.

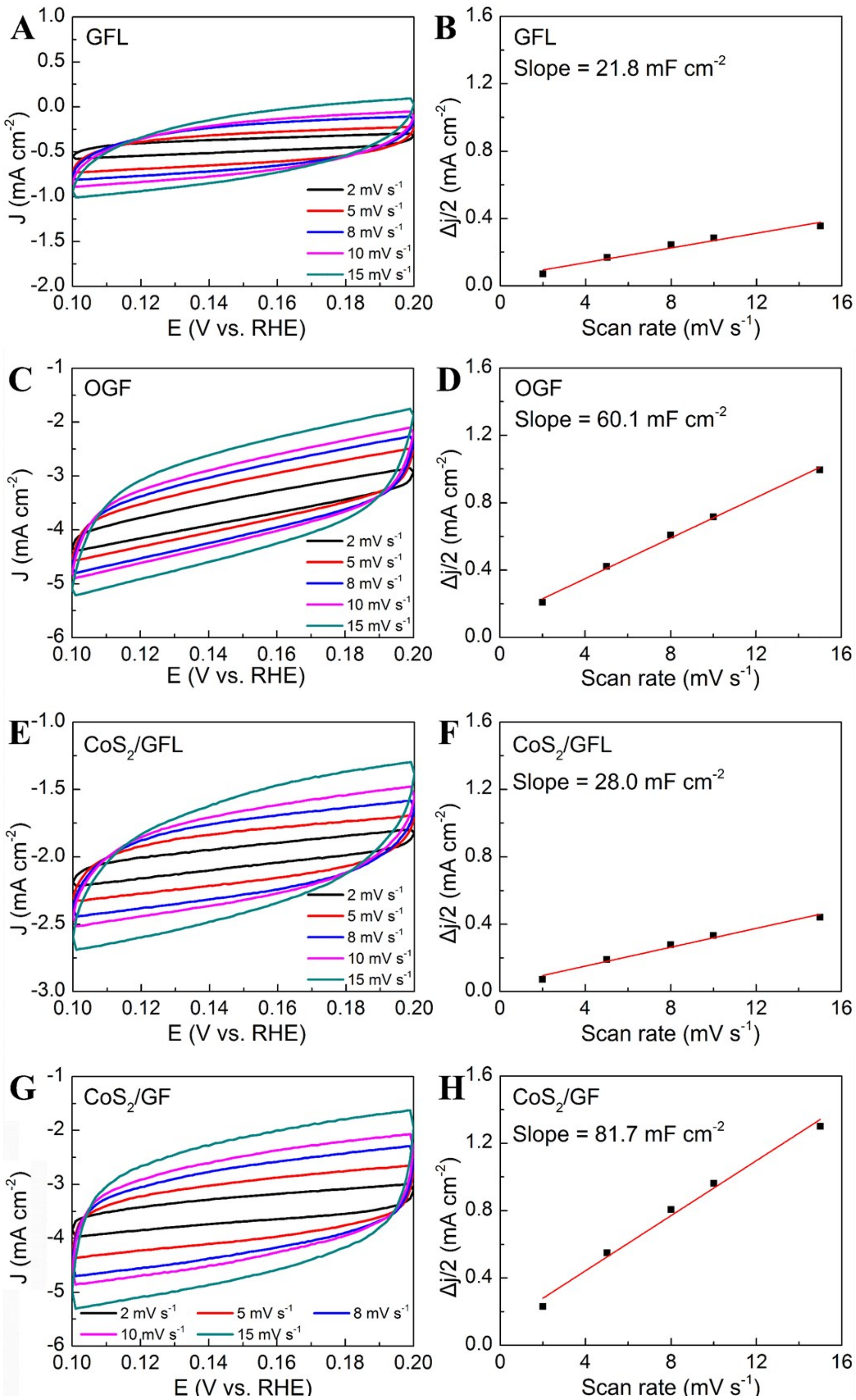

Fig. S7 Cyclic voltammograms (CVs) curves for (A) GFL, (C) OGF, (E) CoS_2/GFL and (G) CoS_2/GF in 1.0 M KOH at different scan rates. (B, D, F and H) Plots of capacitive currents measured from corresponding left CV cycles versus scan rate.

Supplementary References

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