Supporting Information

Cobalt disulfide supported on porous carbon foam for high performance hydrogen evolution reaction

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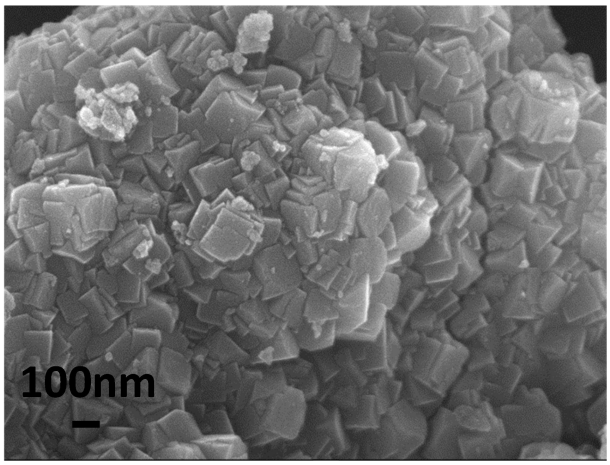


Figure S1. SEM images of pure CoS_2**.**

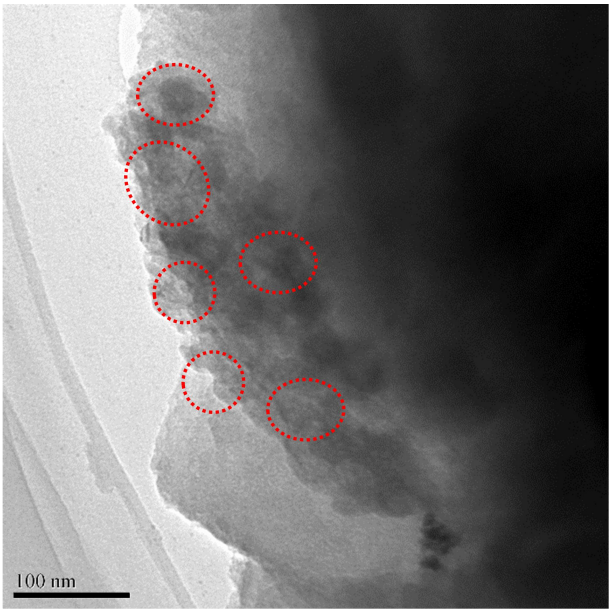
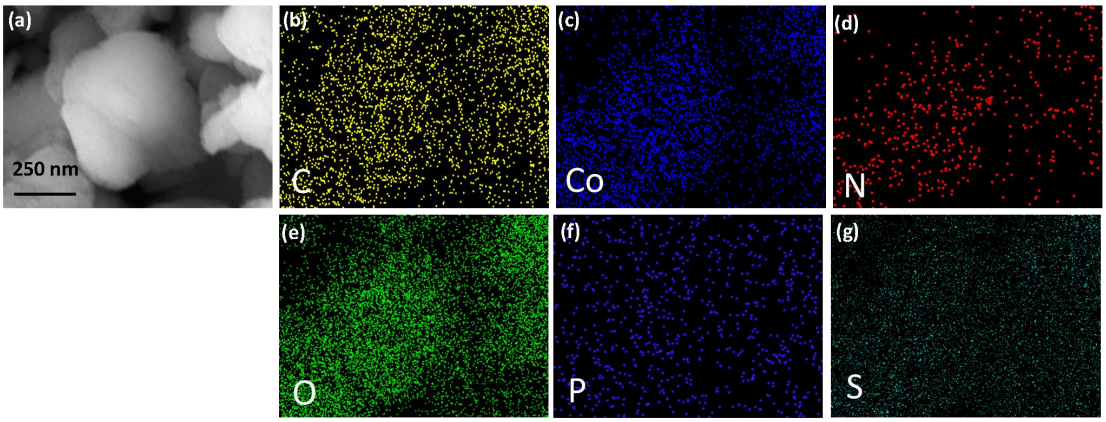


Figure S2. TEM images of CoS_2-CF-4. The red dotted circles are the CoS_2 loaded on the surface of carbon foam .



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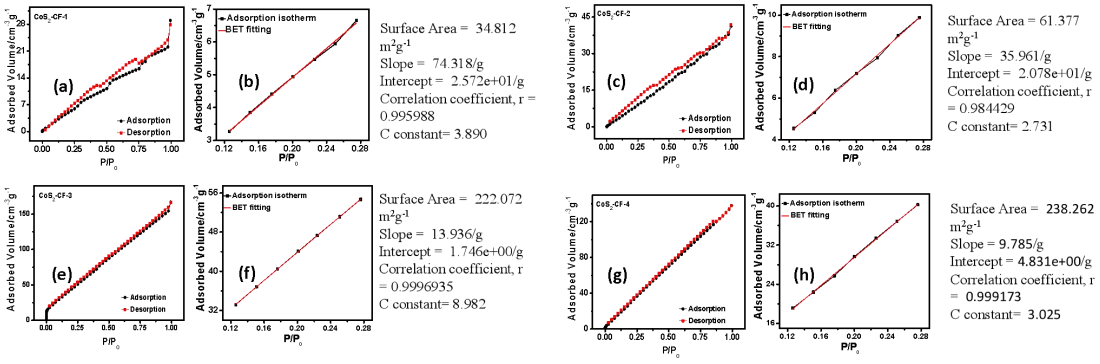

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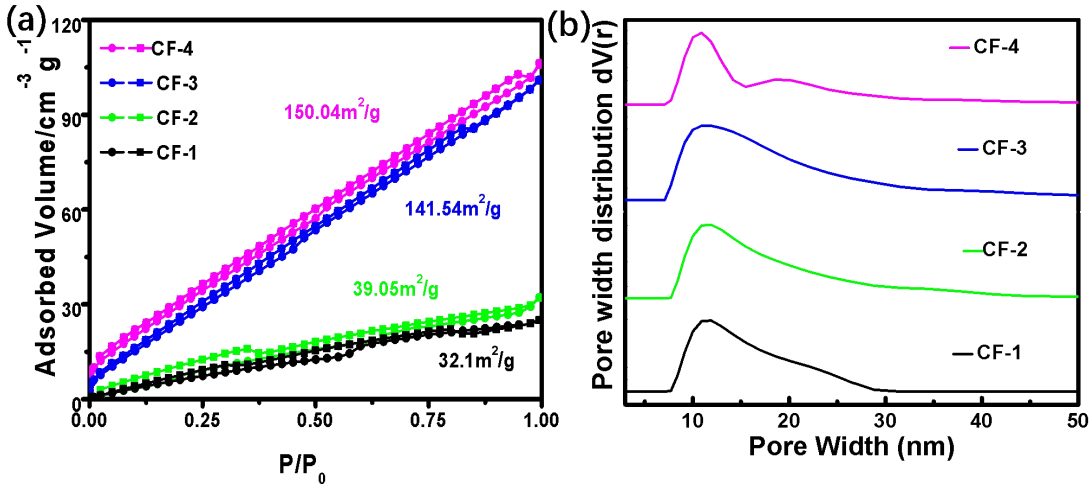

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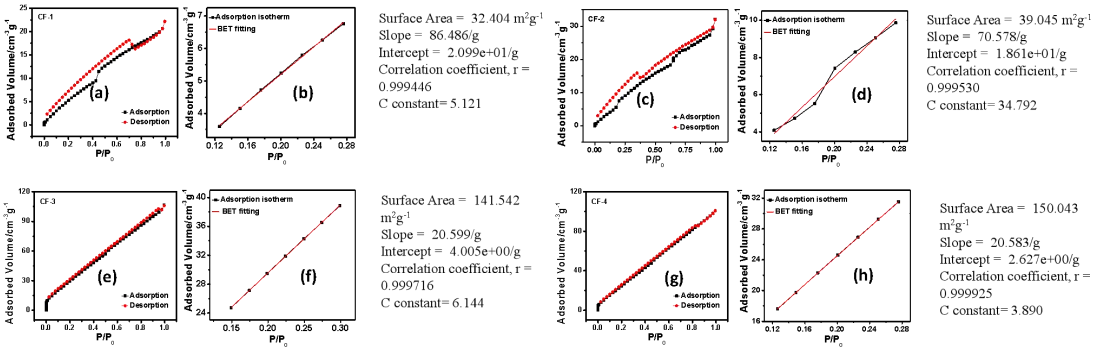
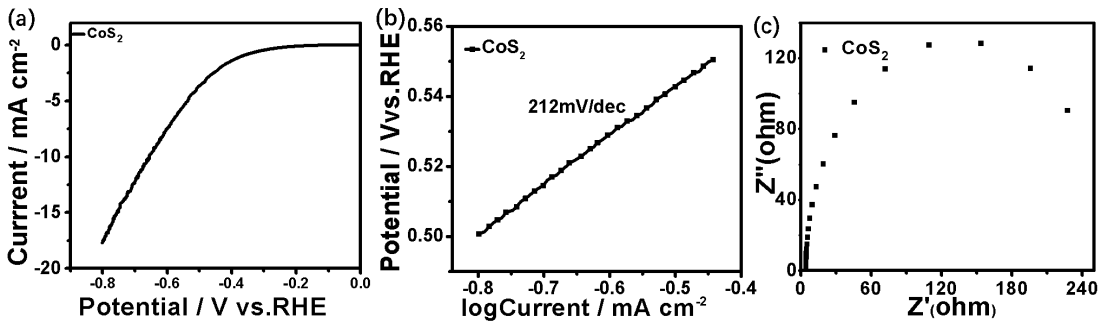


Figure S6. The N_2 adsorption/desorption isotherms of CF-X (X=1, 2, 3, 4) composites (a), (c), (e) and (g). The calculated pore parameters of CF-X (X=1, 2, 3, 4) composites (b), (d), (f) and (h).



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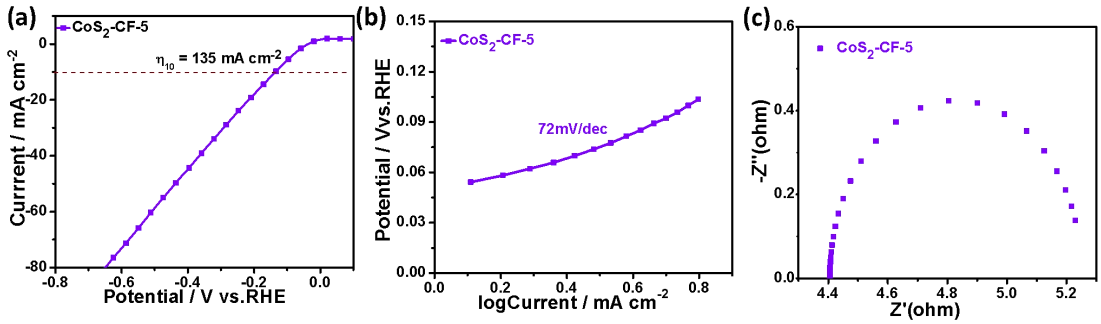

Figure S8. The polarization curves of CoS_2-CF-5 (a)and its corresponding Tafel polts (b)the charge transport resistance of CoS_2-CF-5 (c).

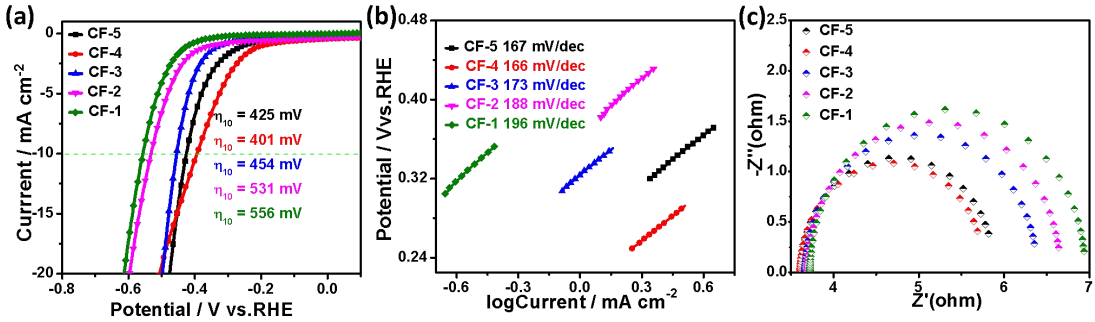

Figure S9. The LSV curves of CF–X (X=1, 2, 3, 4, 5), the corresponding Tafel polts (b) and charge transport resistance (c).

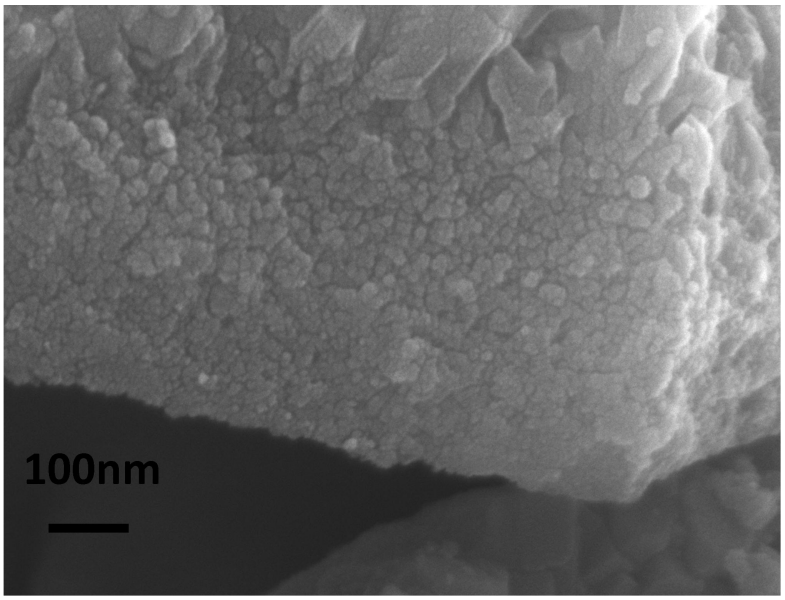

Figure S10. SEM images of CoS_2-CF-4 composite after 4000 linear cycles.

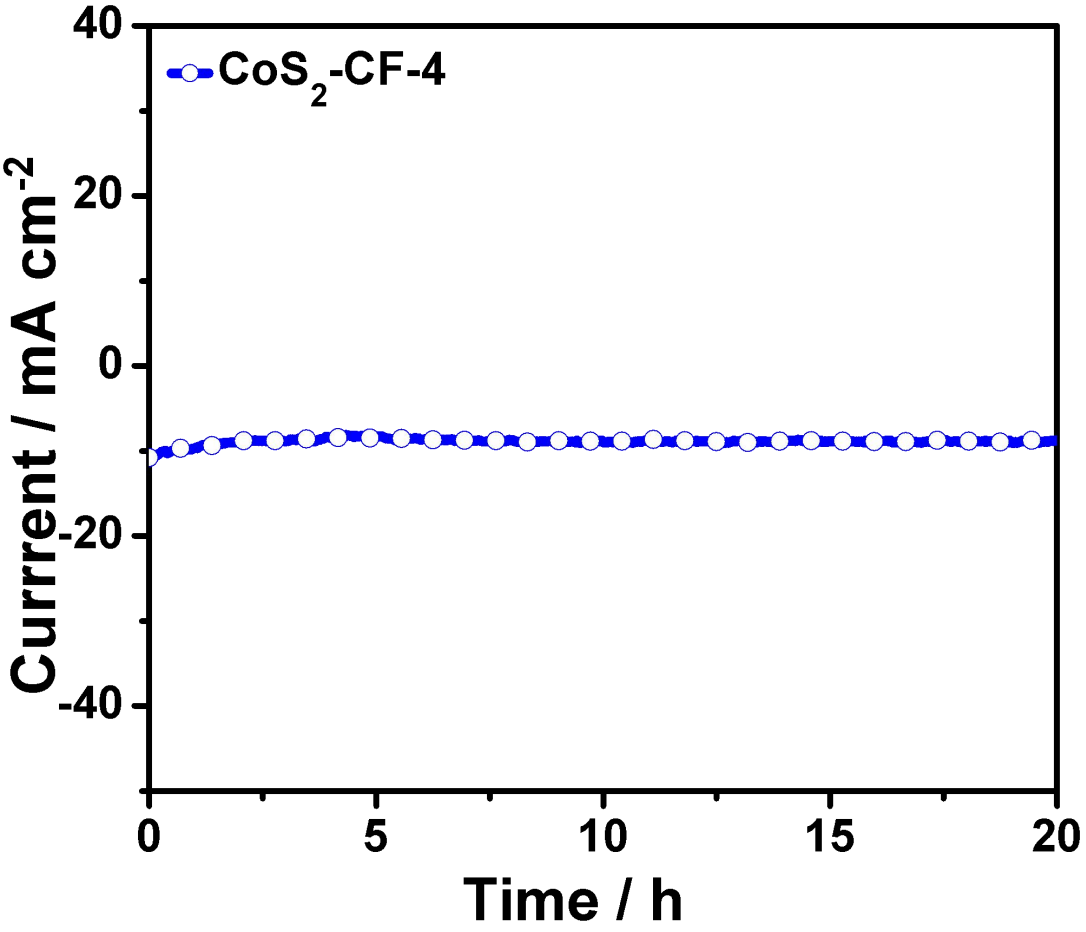

Figure S11. Chronoamperometry test of CoS_2-CF-4.

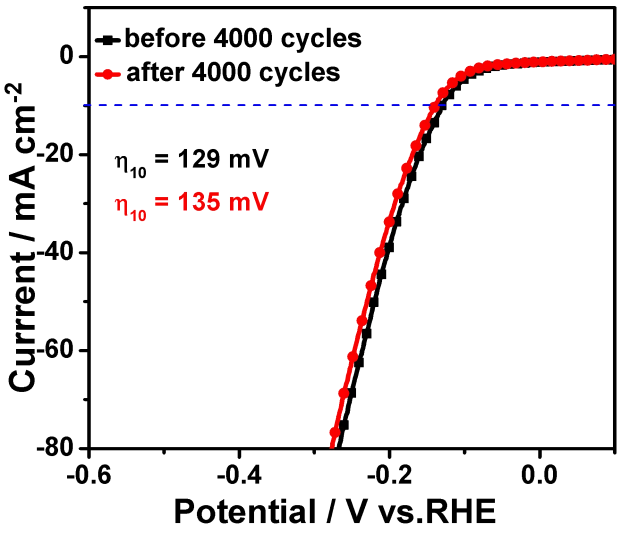

Figure S12. The stability of carbon rod electrode instead of platinum plate.

Table S1. Elemental analysis of CoS_2-CF-4 composite.

Element	NetCounts	Weight %	Atom %
C K	2639	12.79	22.38
N K	256	2.30	3.45
O K	9284	38.81	50.98
P K	85	0.17	0.12
S K	10248	22.41	14.69
Co K	2684	23.52	8.39
		100	100

Table S2. XPS spectra fitting result of CoS_2-CF-4 composite.

C 1s			
Peak Label	Position(eV)	FWHM(eV)	Area
C-C/C＝C	284.58	0.64	25261
C-S	284.94	0.64	14695
C-O/C-N	285.43	1.2	22424
N 1s			
Peak Label	Position(eV)	FWHM(eV)	Area
Oxidized N	402.22	1.59	5140
Graphitic N	400.64	1.16	606
S 2p			
Peak Label	Position(eV)	FWHM(eV)	Area
S-O	169.4	1.46	16268
$S\text{-}2p_{1/2}$	163.88	1.14	1112
$S\text{-}2p_{3/2}$	163.06	1.18	675
Co 2p			
Peak Label	Position(eV)	FWHM(eV)	Area
satelite	804.35	4.1	8148
Co^{2+}	782.43	2.5	19669
Co^{2+}	798.68	2.43	9317
Co^{2+}	785.36	3.44	11178
O 1s			
Peak Label	Position(eV)	FWHM(eV)	Area
C-OH	533.38	1.17	36230
C-O/ O-C-N	532.44	0.81	45410
Co-O	531.81	0.52	14121
P 2p			
Peak Label	Position(eV)	FWHM(eV)	Area
Oxidized-P	135.13	1.59	609
Graphitic N	134.09	2.03	403

FWHM: full width half maximum.

Atomic percent of CoS_2-CF-4 composite with XPS measurements.

Materiales	C1s	N1s	S2p	Co2p	O1s	P2p
Atomic %	76.69	2.51	3.83	0.38	16.36	0.58

Through XPS measurements, the atomic percent of C could be obtained of 76.69 %, which was calculated to the mass content of 66.92 wt %. Besides, we calculated the S

of 8.91 wt %and Co of 1.63 wt % through the XPS analysis. The mass percentage of N was 2.19 wt%.

Table S3. The mechanism process in the electrochemical hydrogen evolution reaction (HER) .

Step	Reaction
Volmer step	$H^+ + e^- \rightarrow H_{ad}$
Heyrovsky step	$H_{ad} + H^+ + e^- \rightarrow H_2$
Tafel step	$2H_{ad} \rightarrow H_2$

Table S4. HER activity of CoS_2- CF- X and CF–X composite

Catalyst	Current Density (j, $mA \cdot cm^{-2}$)	Overpotential at the corresponding j(mV)	Tafel slope ($mV \bullet dec^{-1}$)
CoS_2-CF-1	10	273	93
CoS_2-CF-2	10	250	92
CoS_2-CF-3	10	157	82
CoS_2-CF-4	10	121	68
CoS_2-CF-5	10	135	72
CF-1	10	556	196
CF-2	10	531	188
CF-3	10	454	173
CF-4	10	401	166
CF-5	10	425	167