Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Information

Symmetric synergy of hybrid CoS_2-WS_2 electrocatalysts for hydrogen evolution reaction

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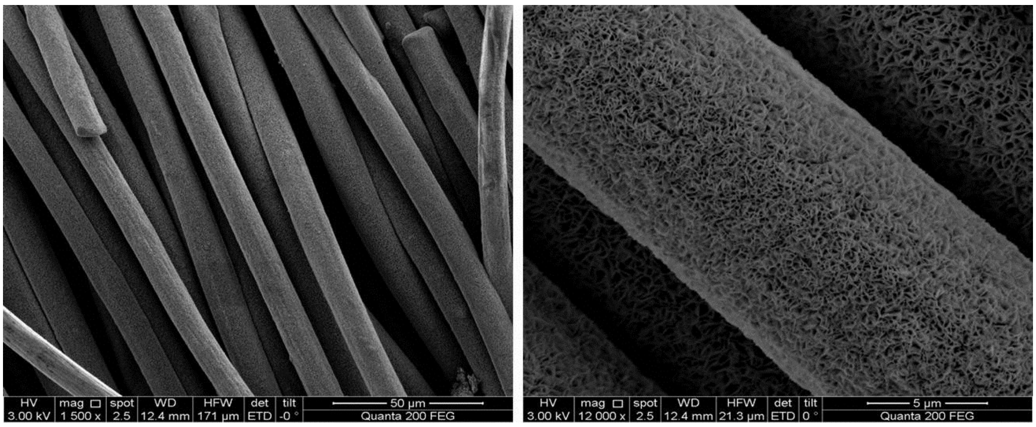

Figure S1. SEM images of $Co(OH)_2$/CC with different magnifications.

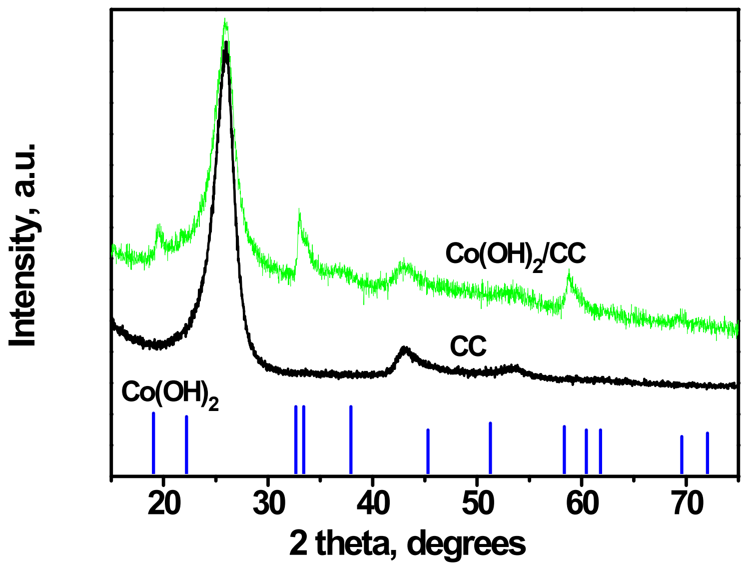

Figure S2. XRD patterns of the electrochemical deposited $Co(OH)_2$ on carbon cloth (CC) and bare CC.

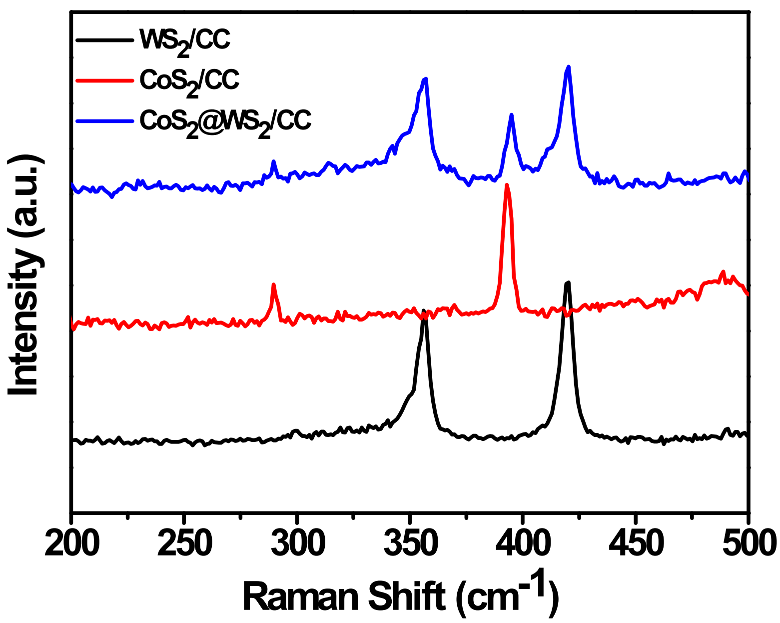

Figure S3. Raman spectrum of the samples WS_2/CC, CoS_2/CC, and CoS_2@WS_2/CC.

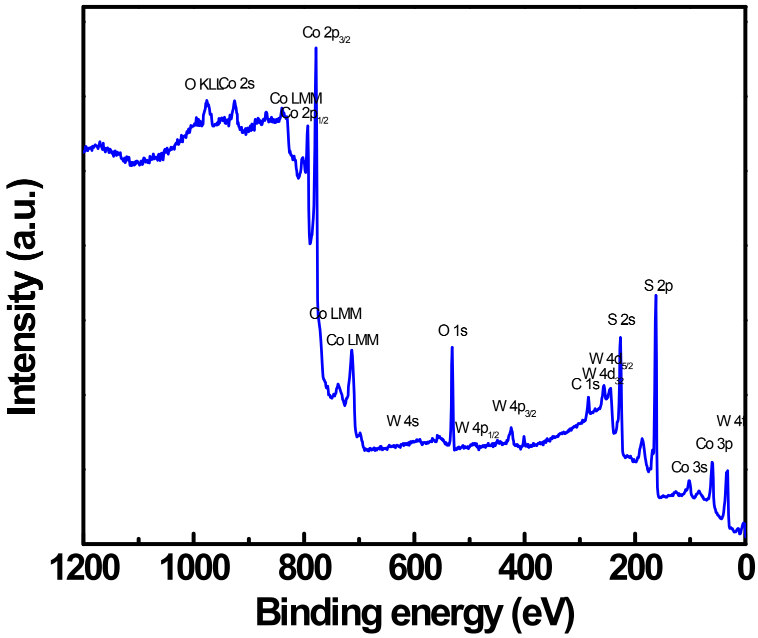

Figure S4. The XPS survey spectra of CoS_2@WS_2/CC sample.

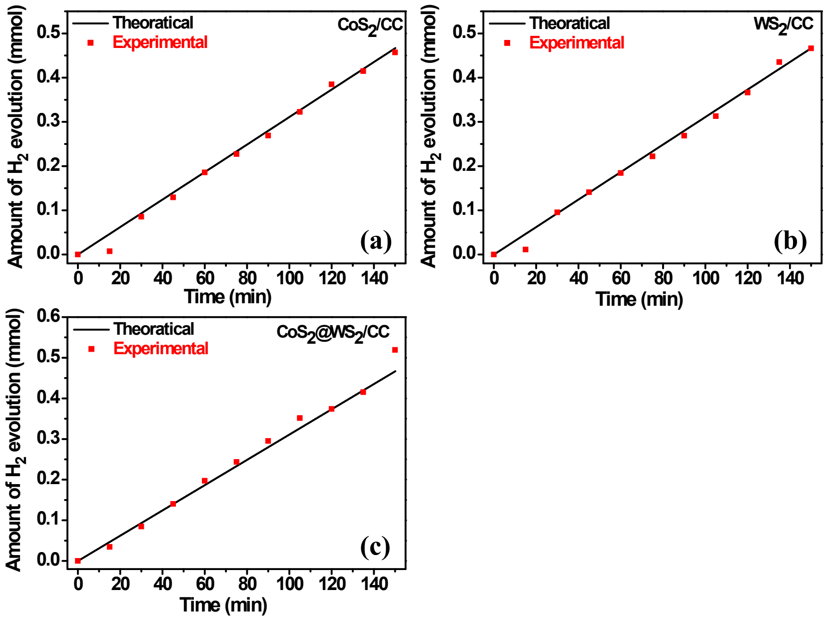

Figure S5. Faradic efficiency of HER in 0.5 M H_2SO_4 solution with CoS_2/CC, WS_2/CC, and CoS_2@WS_2/CC as the cathode, respectively.

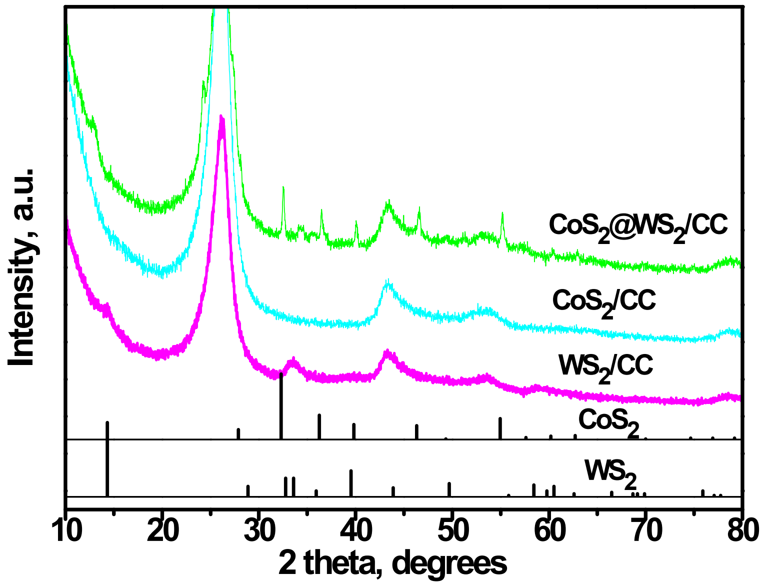

Figure S6. XRD patterns of samples CoS_2/CC, WS_2/CC, and CoS_2@WS_2/CC after the stability evaluation.

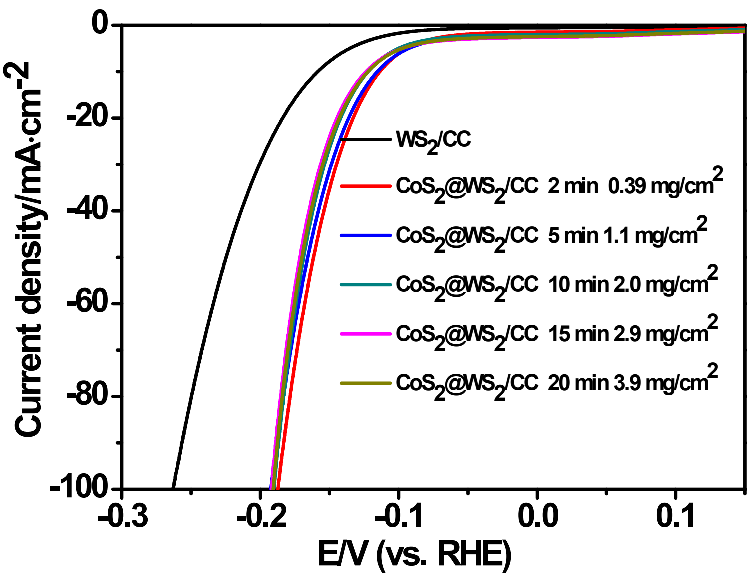

Figure S7. Polarization curves of WS_2 (loading of 4.0 mg/cm^2) and a series of CoS_2@WS_2/CC samples with fixed amount of WS_2 (loading of 4.0 mg/cm^2) and different electrodeposition amounts of CoS_2, where the current is normalized by the geometrical area of carbon cloth and the potential is after internal resistance correction.

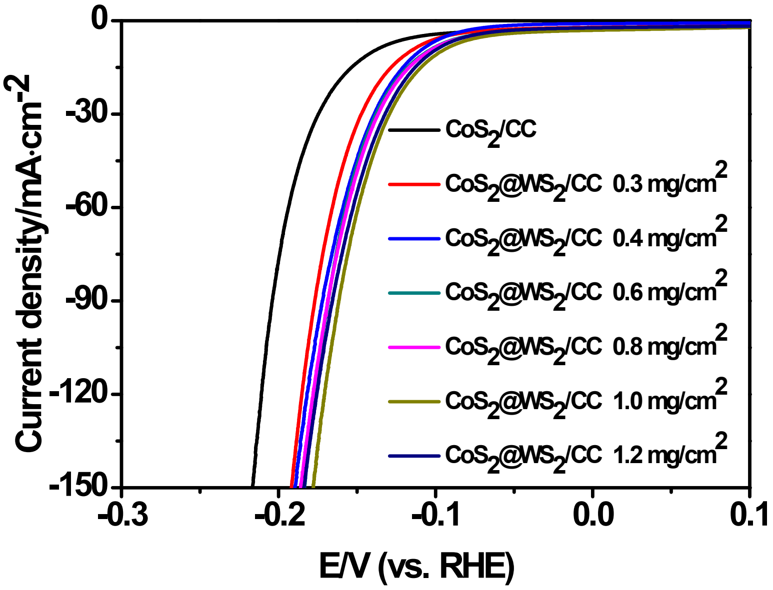

Figure S8. Polarization curves of CoS_2 (loading of 2.0 mg/cm^2) and a series of CoS_2@WS_2/CC samples with different dip-coating content of WS_2, where the current is normalized by the geometrical area of carbon cloth and the potential is after internal resistance correction.

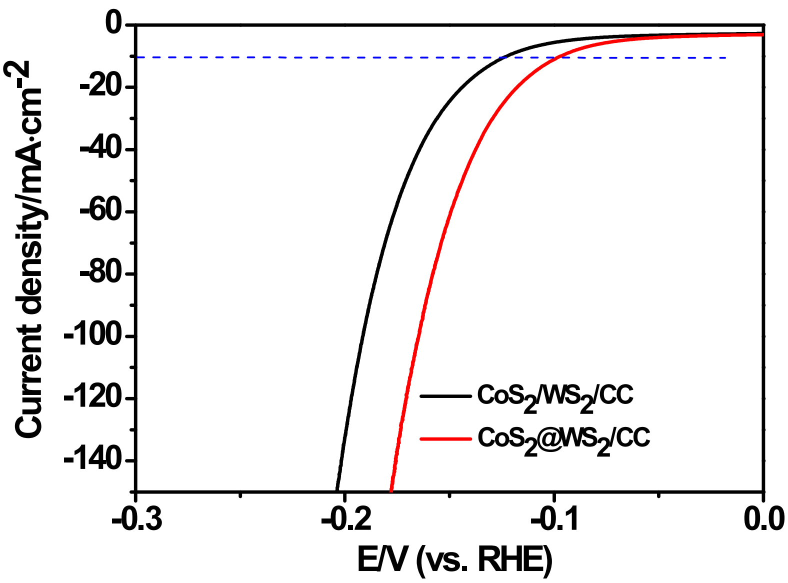

Figure S9. Polarization curves of $CoS_2/WS_2/CC$ (preparing by a two-step of thermolysis) and $CoS_2@WS_2/CC$ (preparing by a one-step of thermolysis) samples, where the current is normalized by the geometrical area of carbon cloth and the potential is after internal resistance correction.

Table S1. Comparison of HER performance for CoS_2-based and WS_2-based sulfides catalysts published recently.

Catalyst	substrate	Loading amount (mg/cm^2)	Current density (j, mA/cm^2)	Overpotential at the corresponding j (mV)	Tafel slope (mV/dec)	Electrolyte Conc. (H_2SO_4)
CoS_2 (this work)	CC	2.0±0.1	-10	-140.3	71.5	0.5 M
WS_2(this work)	CC	1.0±0.1	-10	-151.7	79.6	0.5 M
CoS_2@WS_2(this work)	CC	2.9±0.1	-10	-97.2	66.0	0.5 M
CoWS[1]	glassy carbon	5.11	-10	-236	74	0.5 M
CoS_2@MoS_2 nanoarray[2]	Ti foil	---	-10	-110.5	57.3	0.5 M
MoS_2/CoS_2 nanorods[3]	CC	18.6	-10	-87	73.4	0.5 M
CoS_2[3]	CC	16.5	-10	-288	210.7	0.5 M
CoS_2 thin film[4]	graphite disk	---	-10	-192	52	0.5 M
CoS_2 nanowire[5]	graphite disk	1.7±0.3	-10	-145	51.6	0.5 M
N-doped CoS_2[6]	carbon black and glass carbon	0.32	-10	-57	48	0.5 M
WS_2 nanoparticles[7]	CC	14	-42	-300	78	0.5 M
WS_2 nanosheets[8]	graphite disk	1.0±0.2	-10	-142	70	0.5 M
WS_2 nanoribbons [9]	glassy carbon	---	-10	-225	68	0.5 M
WS_2 nanoflakes[10]	FTO	1.0	-2.1	-200	200	0.5 M
WS_2@WS_2 nanorattle[11]	glassy carbon	0.35	-71	-300	68	0.5 M

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