Supporting Information For

Highly efficient oxygen evolution from CoS_2/CNTs nanocomposite via one-step electrochemical deposition and dissolution method

Jizhang Yang[a], Zhi Yang[a*], Lu Hua Li[b], Qiran Cai[b], Huagui Nie[a], Mengzhan Ge[a], Xi'an Chen[a], Ying Chen[b], Shaoming Huang[a, c] *

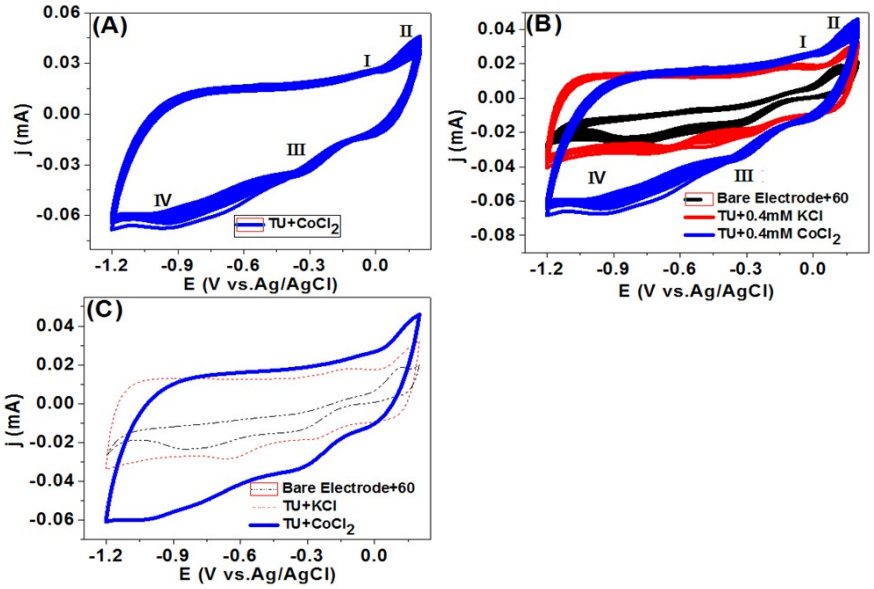

Figure S1. Electrodeposition cyclic voltammetry (CVs) of CoS_2. (A) 0.4mM$CoCl_2$ containing 0.06M thiourea electrolyte on CNT; (B) Deposited on the various substrates: Bare Electrode (Bare glass carbon electrode, black), CNT (red: TU+KCl electrolyte, blue: TU+$CoCl_2$ electrolyte). scan rate 30 mV s^{-1}..

Table S1 Comparison of catalytic parameters of different OER catalysts.

Samples	Onset Potential (V vs. RHE, iR-corrected)	η(mV) @j=10mAcm^{-2}	η(mV) @j=20mAcm^{-2}
Raw CNT	1.57	-	-
Bare elec.+60	1.46	338	375
IrO_2	1.43	321	371
CNT-CoS_2-20	1.42	335	374
CNT-CoS_2-40	1.43	338	376
CNT-CoS_2-60	**1.33**	**290**	**321**
CNT-CoS_2-80	1.34	311	350
CNT-CoS_2-120	1.52	482	-

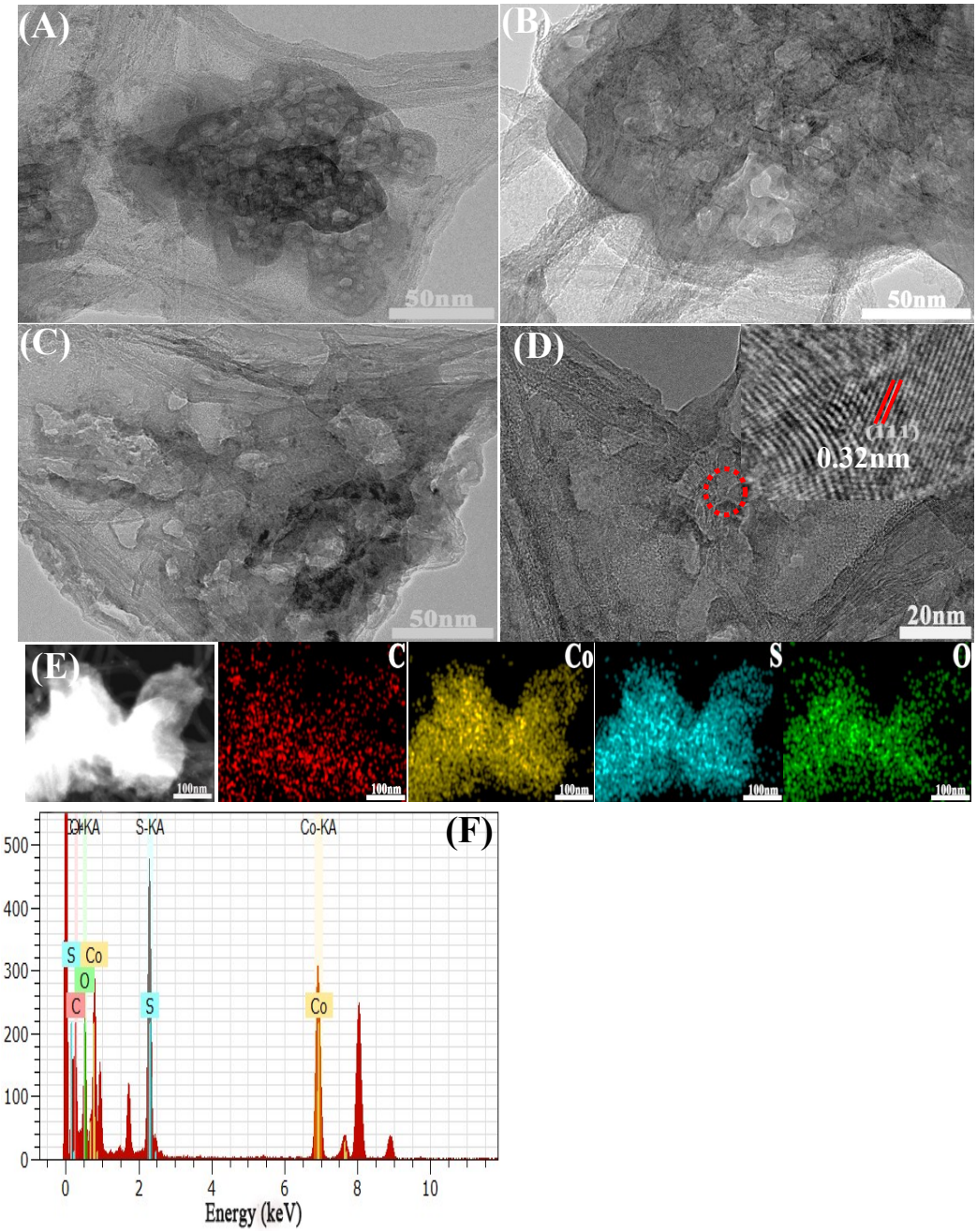

Figure S2. TEM images of (A-D) CNT-CoS_2-60 and (E) STEM and corresponding element mapping. (F) EDS of CNT-CoS_2-60.

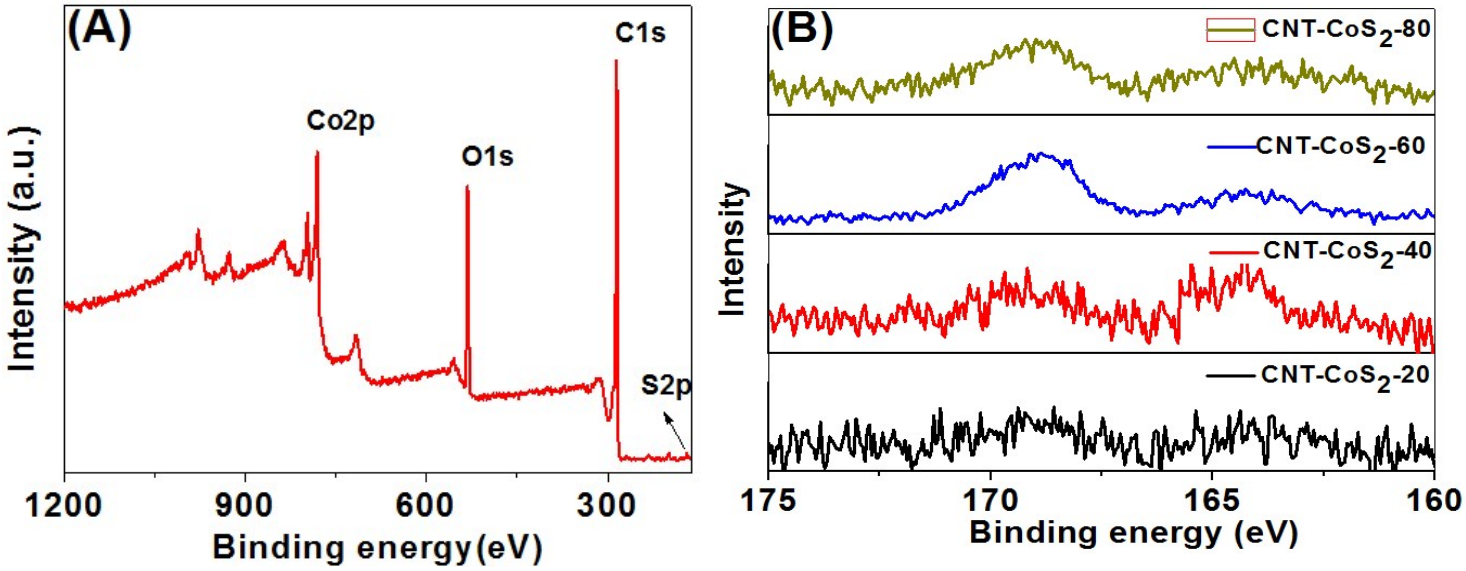

Figure S3. (A) XPS spectra survey of the CNT-CoS_2-60; (B) S 2p region.

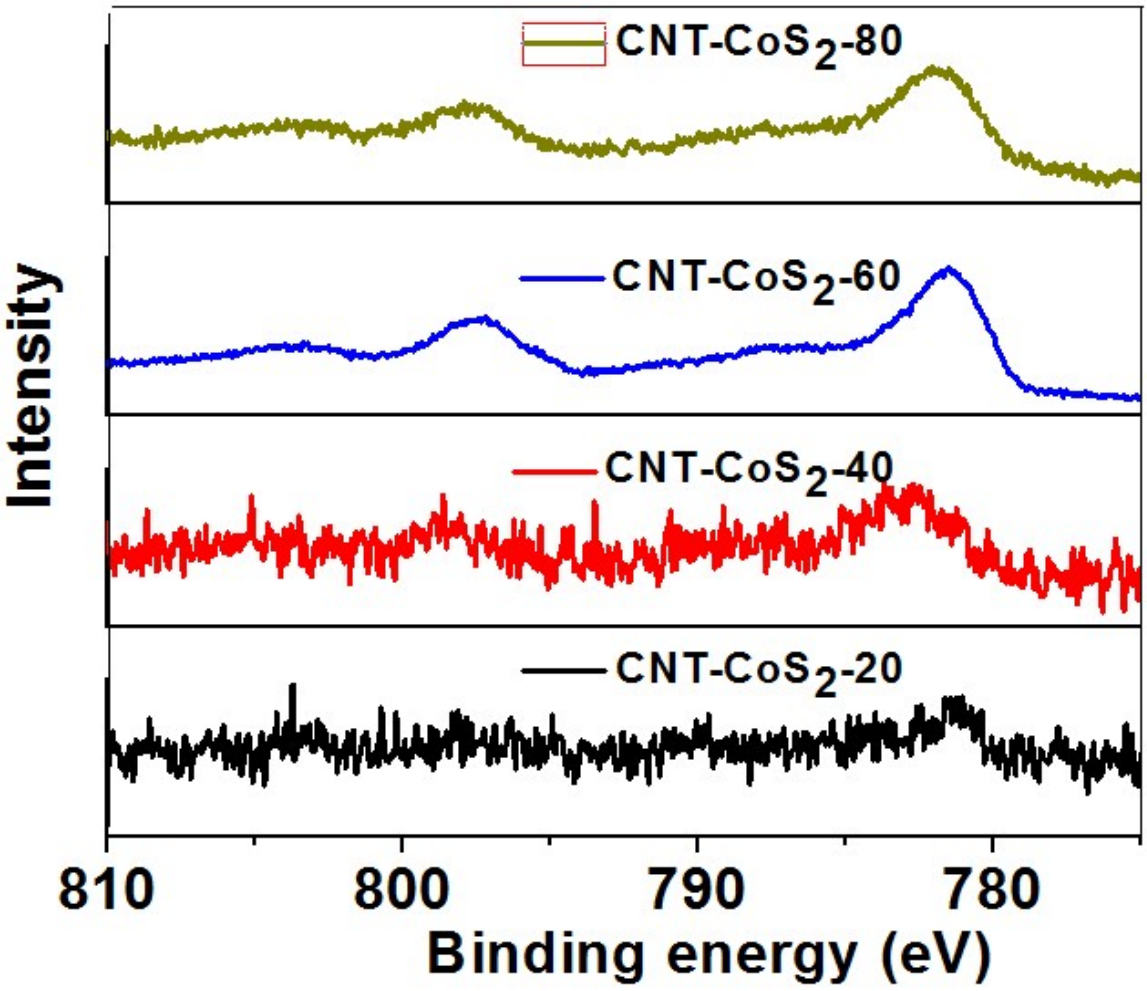

Figure S4. Co 2p spectra in CNT-CoS_2.

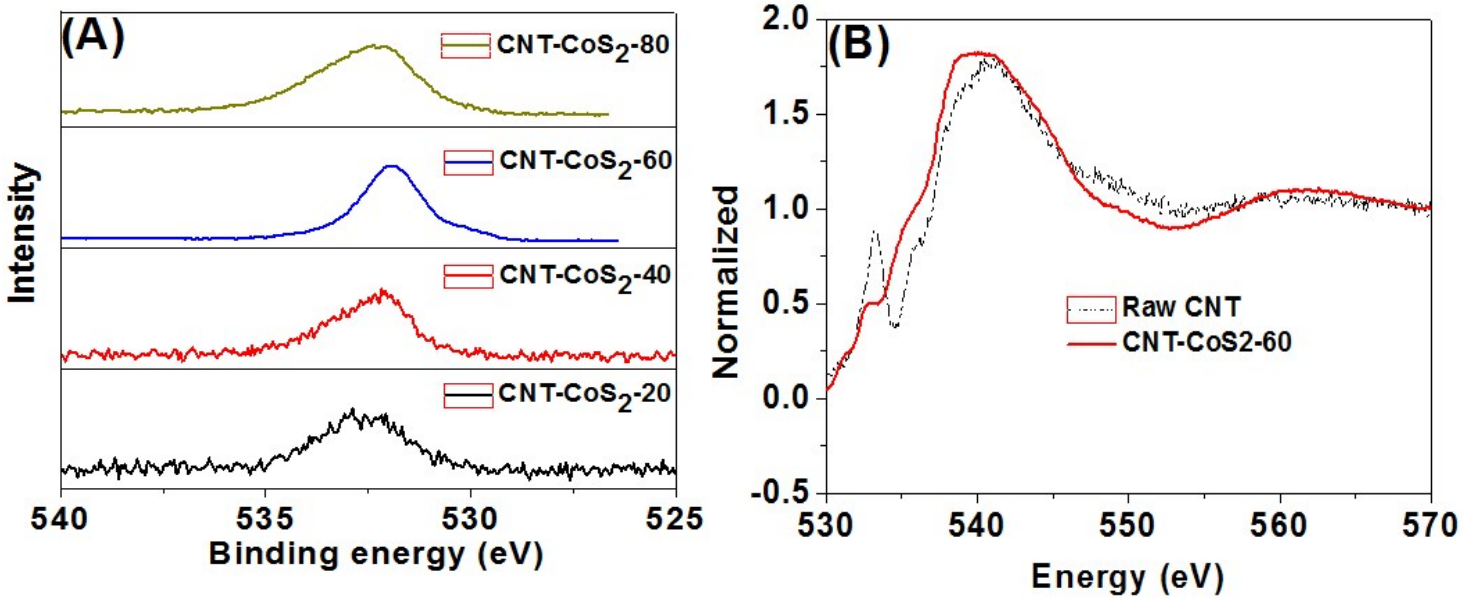

Figure S5. (A)O 1s region; (B) NEXAFS characterization of O K-edge.

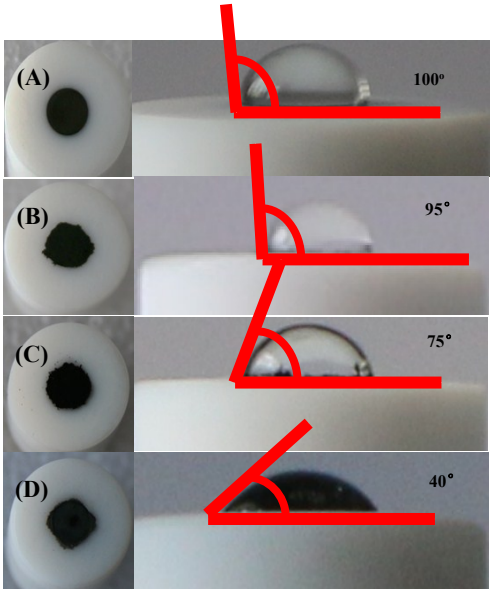

Figure S6 Contact angle of different electrodes: (A) GCE; (B) Raw CNT; (C) CNT/CoS_2; (D) CNT-CoS_2-60.

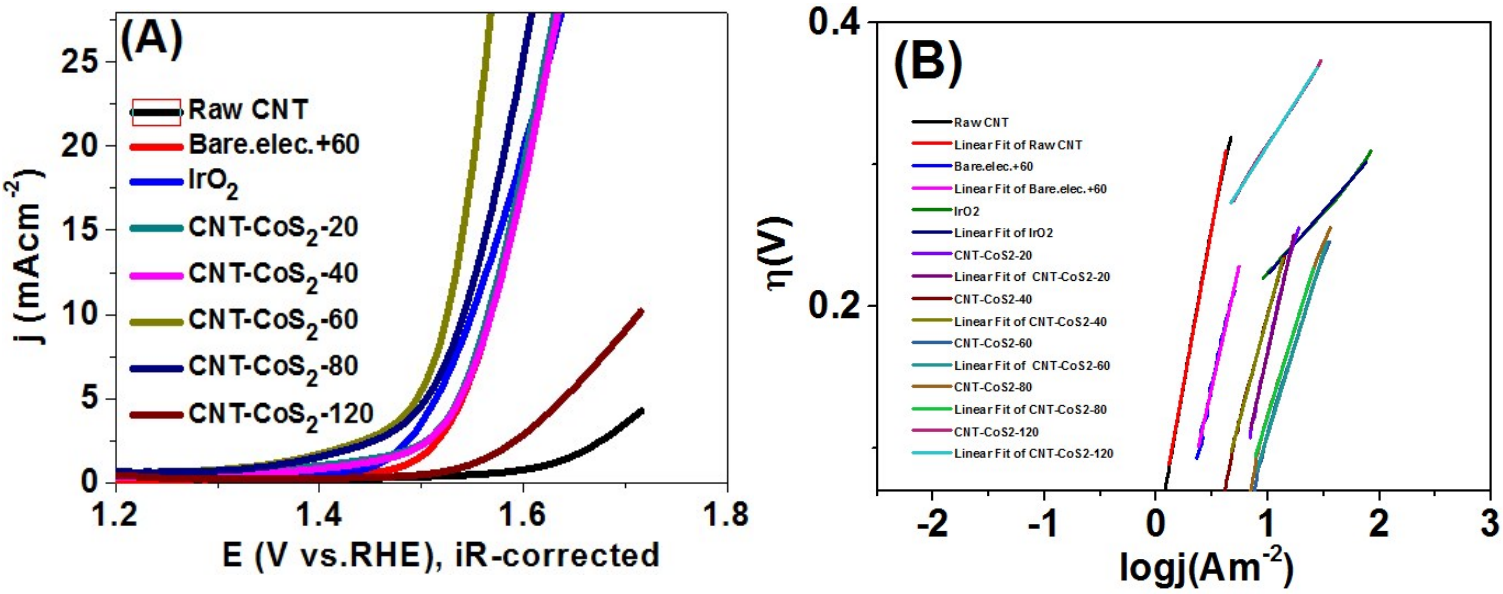

Figure S7. (A) iR-corrected Polarization curves for various CNT-CoS_2. (B) iR-corrected Tafel Plot of (A).

Table S2 Comparison of OER performance in alkaline medium for CNT-CoS-60 with other OER electro-catalysts.

Catalysts	Electrolytes	Onset η(mv)	η(mV) @j=10mAcm^{-2}	Tafel slope (mvdec^{-1})	Ref.
CNT-CoS_2-60	**0.1M KOH**	**100**	**290**	**255**	**This work**
$Ni_2Co_1/Ni_2Co_1O_x$	0.1M KOH	320	380	105	Adv. Funct. Mater. 2016,26, 5998–6004.
	1M KOH	270	320	42	
NiCoP/rGO	1M KOH	251	270	65.7	Adv. Funct. Mater. 2016, 26, 6785–679.
$NiCo_2S_4$	1M KOH	240	260	40.1	Adv. Funct. Mater. 2016, 26, 4661-4672
Co_3S_4 nanosheet	0.1MKOH	280	355	48	Angew. Chem. Int. Ed. 2015, 54, 1– 6
$NiCo_2S_4$@N/S-rGO	0.1M KOH	—	470	—	ACS Appl. Mater. Interfaces 2013, 5,5002.
CoS_2(400)/N,S-GO	0.1M KOH	220	380	75	ACS Catal. 2015, 5, 3625−3637
Co_9S_8@MoS_2/CNF	1 M KOH	350	430	61	Adv. Mater., 2015, 27, 4752-4759.
Co_2B-500	0.1M KOH	250	380	45	Adv. Energy Mater. 2016, 1502313
Co-Bi NS/G	1M KOH	235	290	53	Angew. Chem. Int. Ed. 2016, 55, 1–6
$NiCo_2O_4$	1M KOH	230	290	53	Angew. Chem. Int. Ed. 2016, 55, 1–6.
$Co_3O_4/NiCo_2O_4$	1M KOH	300	340	88	J. Am. Chem. Soc. 2015, 137, 5590.
Co-CoOx@CN	1M KOH	270	260	—	J. Am. Chem. Soc. 2015, 137, 2688.
Co-P film	1M KOH	345	345	47	Angew. Chem. Int. Ed. 2015, 54, 6251.
NiCo LDHs	1M KOH	312	367	40	Nano Lett. 2015, 15, 1421.
$MnCo_3O_4$	0.1M KOH	290	510	55	Adv.Funct.Mater. 2015,25,393-399
Zn-Co-LDH NS	0.1M KOH	230	480	101	J. Mater. Chem. A 2015, 3, 6878.
$CeO_2/CoSe_2$	0.1M KOH	160	288	44	Small 2015, 11, 182 .
$ZnxCo_{3-x}O4$–3:1	1M KOH	290	320	51	Chem.Mater.2014, 26, 1889.
$LiCoO_2$	0.1M KOH	330	—	52	Nat.Commun.2014, 5, 3949.
Fe-Co_3O_4	0.1M KOH	—	486	—	Chem. Mater. 2014, 26, 3162.
CoMn LDH	1M KOH	290	325	43	J. Am. Chem. Soc. 2014, 136, 16481.
CoCo-NS	1M KOH	300	353	45	Nat. Commun. 2014, 5, 4477.
NiCo-NS		280	334	41	
NG-$CoSe_2$	0.1M KOH	293	366	40	ACS Nano 2014, 8, 3970.
Zn-Co-LDH/CNT	0.1M KOH	340	548	—	J. Am. Chem. Soc. 2013, 135, 17242.
NG-NiCo	0.1M KOH	84	—	614	Angew. Chem. Int. Ed. 2013, 52, 13567.
Co_3O_4-$CuCo_2O_4$	0.1M KOH	—	498	—	Chem.Mater.2013, 25, 4926.
PNG-$NiCo_2O_4$	0.1M KOH	310	349	156	ACS Nano 2013, 7, 10190.
$Co(PO_3)_4$	PBS pH=6.4	313	405	74.1	Adv. Funct. Mater. 2013, 23, 227 .
α-FeCoNiOx	0.1M KOH	190	285	31±3	Science 2013,340,60

$Mn_3o_4/CoSe_2$	0.1M KOH	—	450	49	J. Am. Chem. Soc. 2012,134,2930.
CoO(OH)	0.1M KOH	440	650	—	Nat. Mater.2012,11,550
Co_3O_4/SWNT	0.1M KOH	240	580	104	Nano.Res.2012,5,521
CoOx/Au	0.1M KOH	270	551	—	J.Am.Chem.Soc.2011, 133, 5587.
Co_3O_4/graphene	0.1M KOH	300	360	67	Nat.Mater.2011,10,780
$NixCo_{3-x}O_4$	1M KOH	—	420	59	Adv. Mater. 2010, 22, 1926.
Co_3O_4	1M KOH	—	534	≈47±7	J.Phys.Chem. C 2009, 113, 15068.

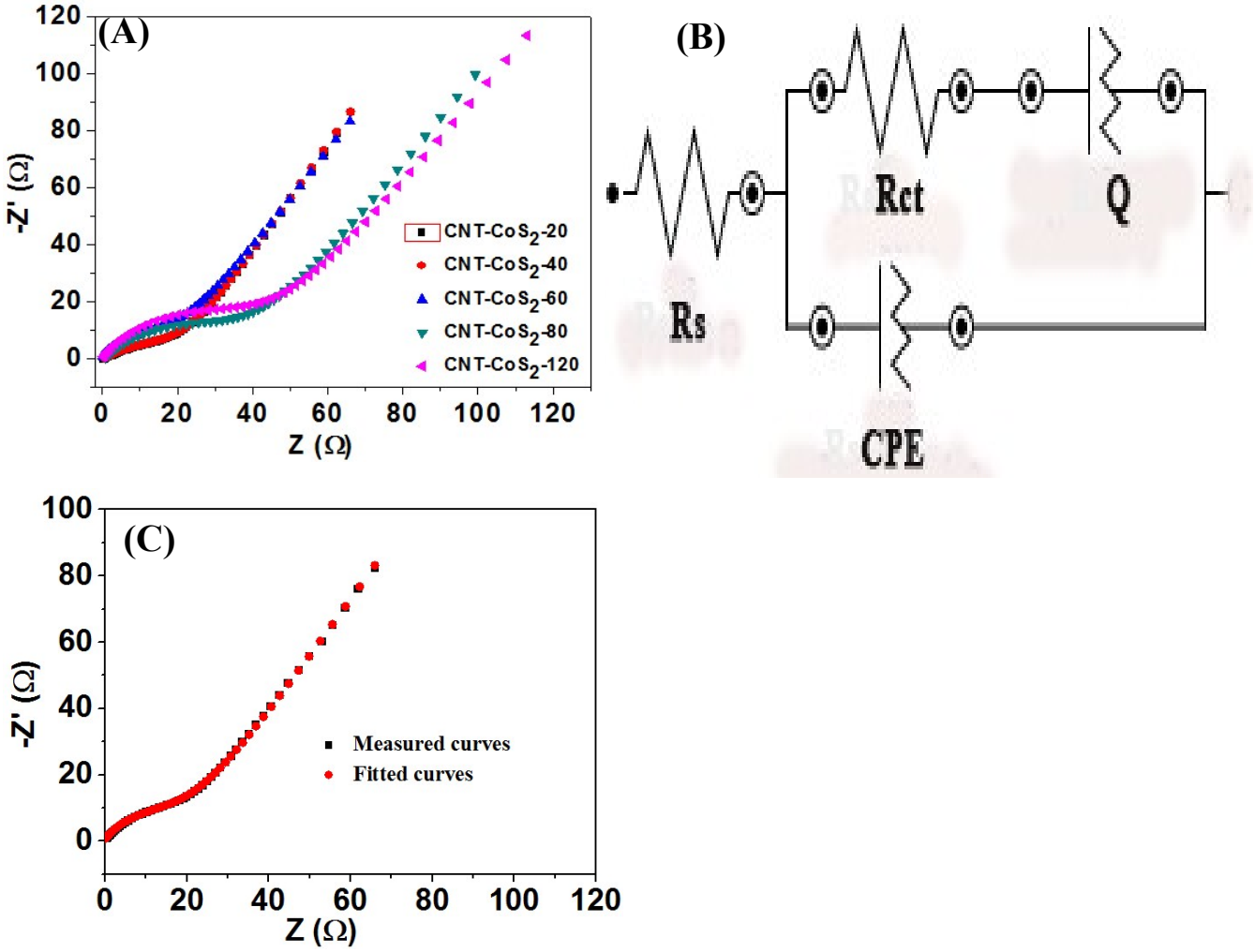

Figure S8. (A) Electrochemical impedance spectroscopy (EIS) of different cycles, condition: 0.01MKOH. (B) Equivalent circuit models OH-/O_2 of CNT-CoS_2-60, (C) The measured and fitted curves of CNT-CoS_2-60.

Table S3 Electrochemical impedance spectroscopy (EIS) parameters of OER catalysts.

Samples	R_s/Ω	R_{ct}/Ω	CPE/μMho	Q/μMho
CNT-CoS_2-20	351	31.3	4.64	310
CNT-CoS_2-40	351	32.7	5.66	294
CNT-CoS_2-60	**334**	**26.4**	**12.1**	**315**
CNT-CoS_2-80	370	46.7	7.63	216
CNT-CoS_2-120	361	49.9	5.47	319

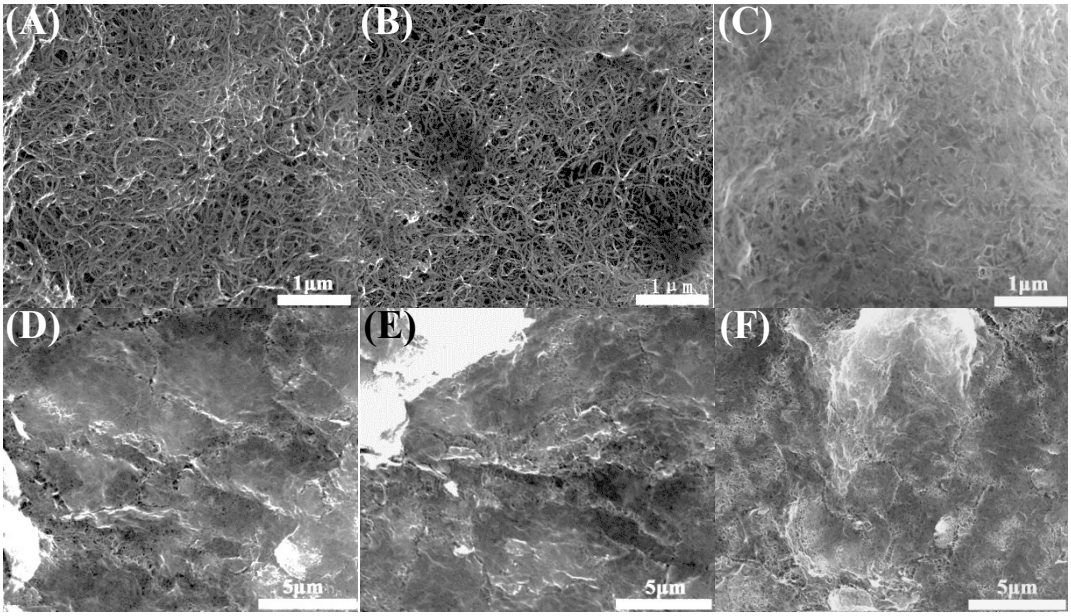

Figure S9. SEM images: (A) CNT-CoS_2-20; (B) CNT-CoS_2-40; (C) CNT-CoS_2-60; (D) CNT-CoS_2-80; (E) CNT-CoS_2-100 and (F) CNT-CoS_2-120.

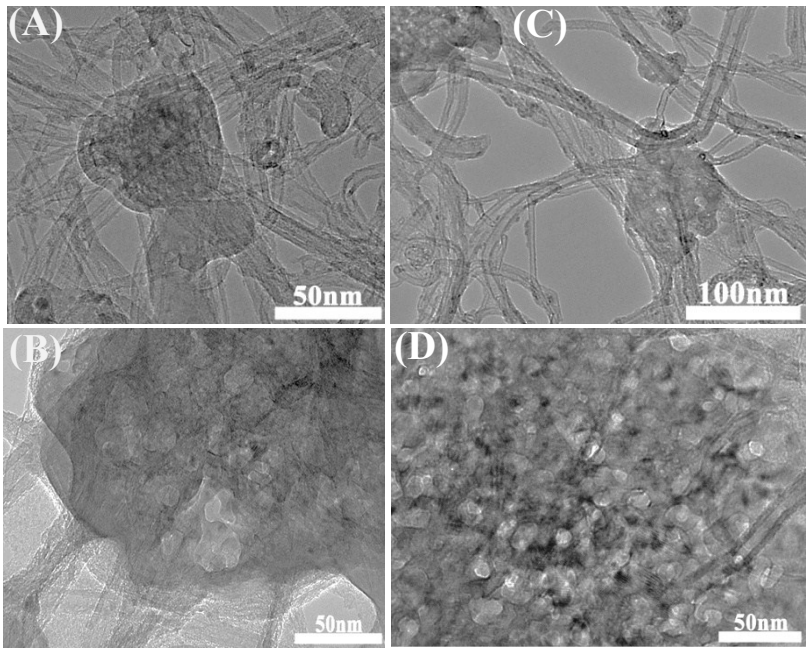

Figure S10. TEM images of different magnification: (A) CNT-CoS_2-40; (B) CNT-CoS_2-60; (C) CNT-CoS_2-80; (D) CNT-CoS_2-120.

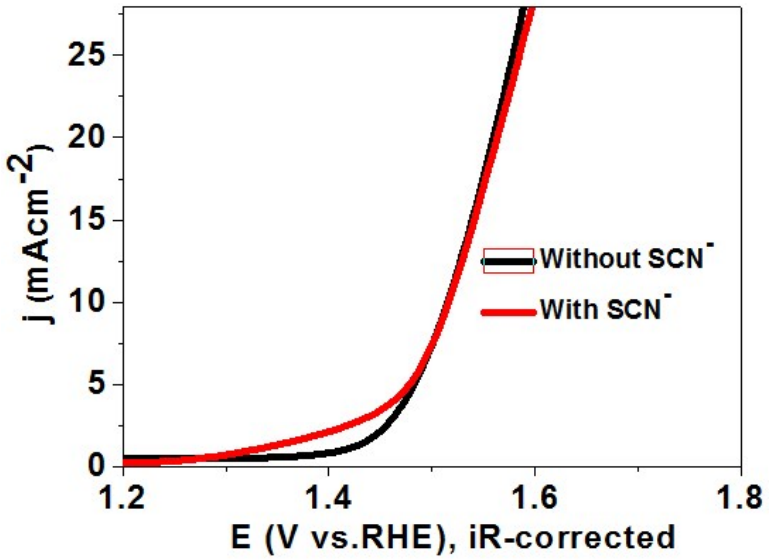

Figure S11. OER iR-corrected polarization plots of IrO_2 in 0.1MKOH with KSCN.