Supporting Information

The Marriage and Integration of Nanostructures with Different Dimensions for Synergistic Electrocatalysis

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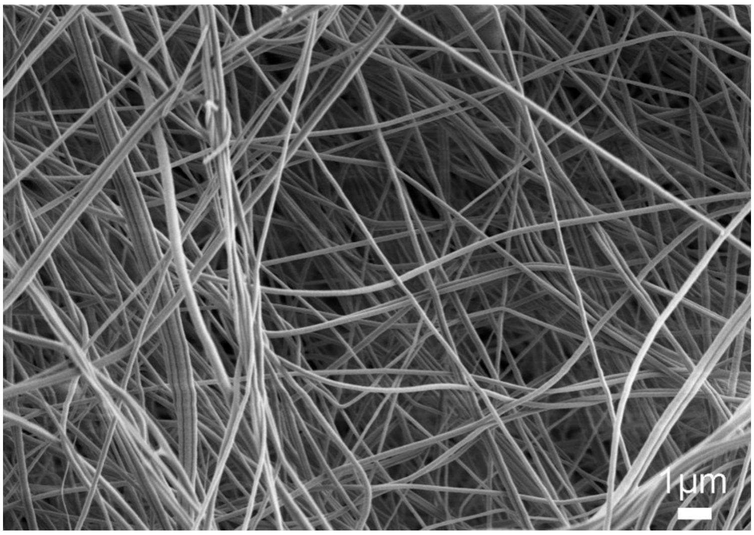

Figure S1 FE-SEM image of the Co-Mn/PAN precursor nanofibers.

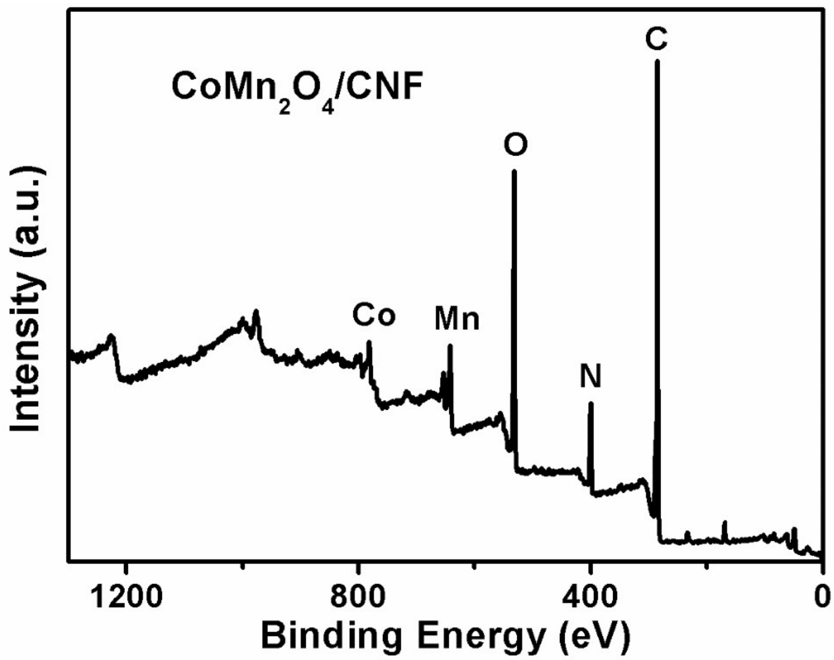

Figure S2 XPS survey spectrum of CoMnO/CNFs prepared at 400 ^{o}C.

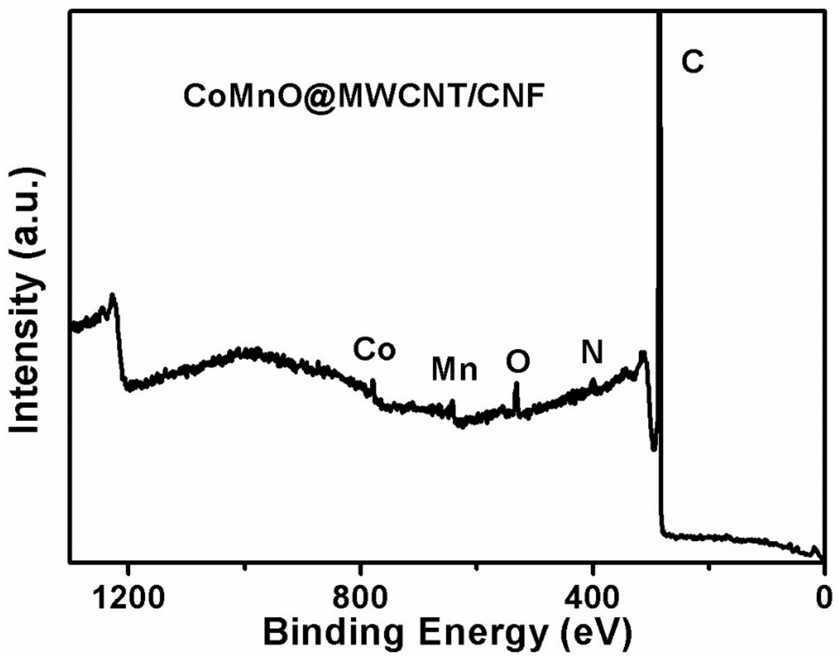

Figure S3 XPS survey spectrum of CoMnO/CNTs/CNFs prepared at 1000 ^{o}C.

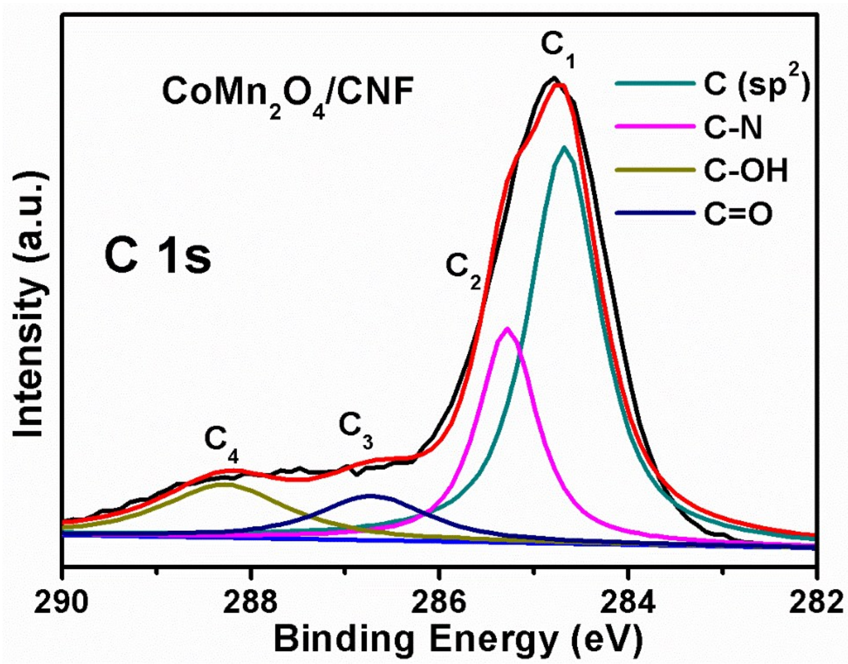

Figure S4 C 1s XPS survey spectrum of CoMnO /CNFs prepared at 400 ^{o}C.

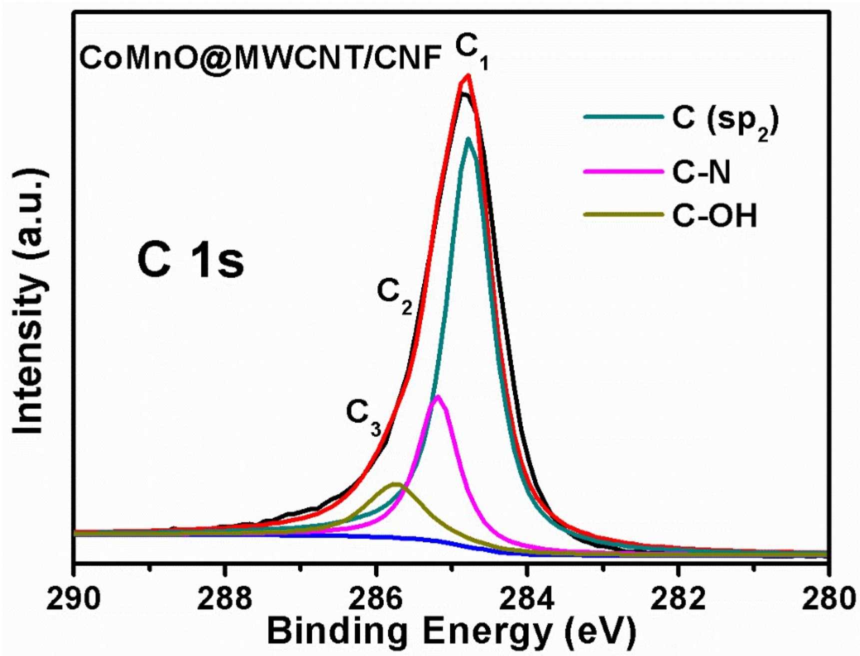

Figure S5 C1s XPS survey spectrum of CoMnO/CNTs/CNFs prepared at 1000 ^{o}C.

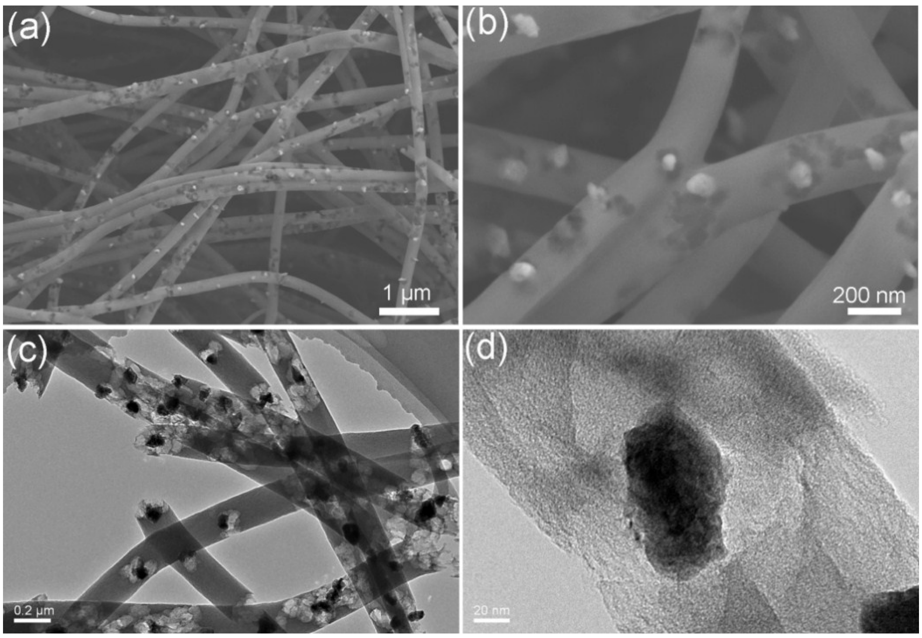

Figure S6 (a, b) FE-SEM and (c, d) TEM images of the Co-CoO/CNFs hybrid prepared at 1000 ^{o}C.

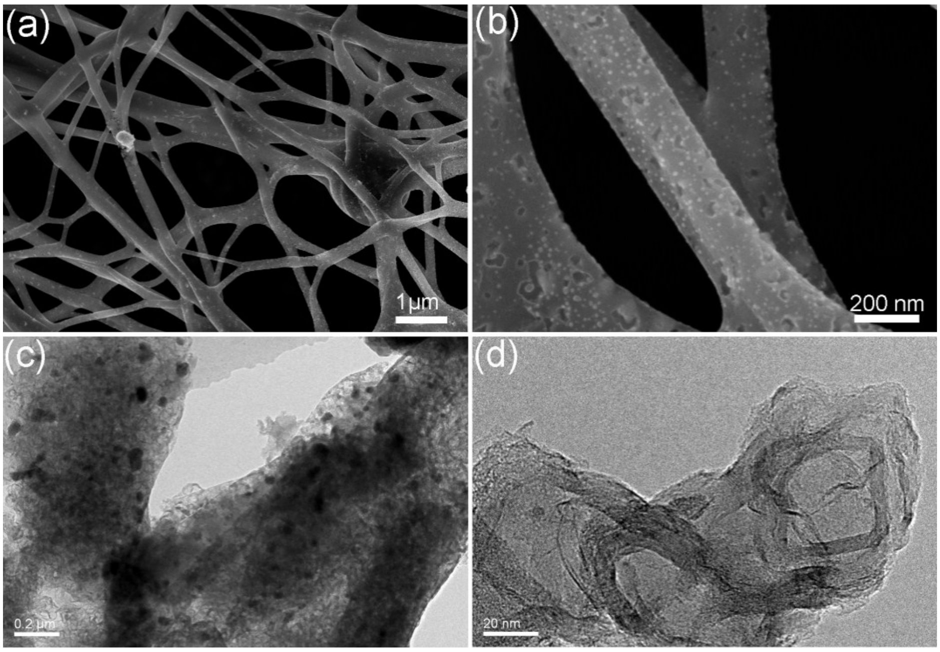

Figure S7 (a, b) FE-SEM and (c, d) TEM images of the Mn-MnOx/CNFs hybrid prepared at 1000 ^{o}C.

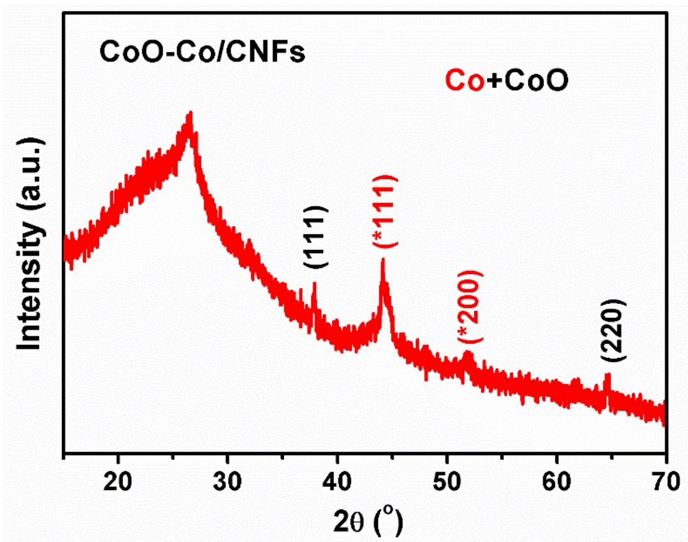

Figure S8 XRD pattern of the Co-CoO/CNFs nanostructures prepared at 1000 ^{o}C.

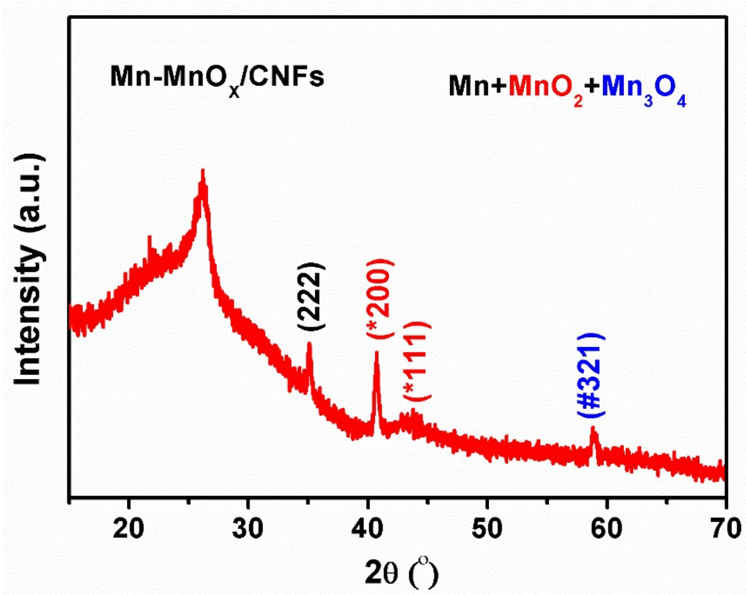

Figure S9 XRD pattern of the Mn-MnO_x/CNFs prepared at 1000 °C.

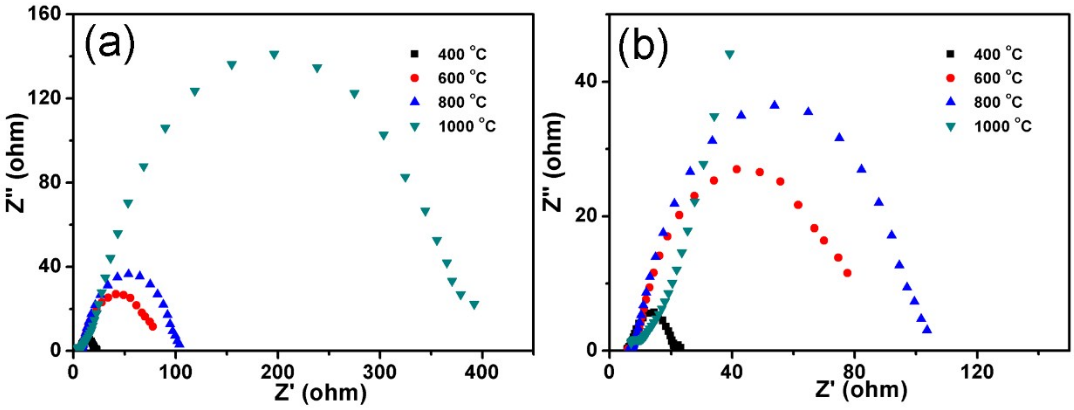

Figure S10 The EIS spectra of the CoMnO@CNTs/CNFs prepared from 400-1000 °C.

Table S1 The comparison of HER activity among recently reported various electrocatalysts.

Catalysts	η at 10 mA cm^{-2} (mV)	Tafel slope (mV dec^{-1})	References
$Co(OH)_2$+Pt(111)	250	-	*Nat. Mater.*, 2012, 11, 550-557
Co-NCNTs	260	80	*Angew. Chem. Int. Ed.* 2014, 53, 4372-4376
$Pr_{0.5}(Ba_{0.5}Sr_{0.5})_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$	237	45	*Adv. Mater.*, 2016, 28, 6442-6448
Co_9S_8@MoS_2/CNFs	190	110	*Adv. Mater.*, 2015, 27, 4752-4759.
CoS_2 nanowire array	145	58	*J. Am. Chem. Soc.* 2014, 136, 10053-10061
Co-N-doped Graphene	187	82	*Nat. Commun.*, 2015, 6, 8668
MoS_2-graphite	195	54	*J. Am. Chem. Soc.* 2013, 135, 10274–10277
Carbon paper/carbon tubes/cobalt-sulfide	190	138	*ACS Nano*, 2016, 10, 2342–2348
MoP	180	54	*Energy Environ. Sci.*, 2014, 7, 2624-2629
$Fe_{4.5}Ni_{4.5}S_8$	190	72	*Nat.Commun.*, 2016, 7, 12269
GO-incorporated Cu-MOF	202	89	*Adv. Funct. Mater.*, 2013, 23, 5363–5372
Mn_3Co_7-$Co_2Mn_3O_8$@CNTs/CNFs	175	98	This work

Table S2 The comparison of OER activity among recently reported various electrocatalysts.

Catalysts	η at 10 mA cm^{-2} (mV)	Tafel slope(mV dec^{-1})	Reference
$Co(OH)_2$+Pt(111)	380	-	*Nat. Mater.*, 2012, 11, 550-557
ZIF-derived Co-NCNTs	370	93	*Nat. Energy*, 2016, 1, 15006
N-doped porous carbon	360	98	*Energy Environ. Sci.*, 2016, 9, 3411-3416
N-graphene-CNTs	420	-	*Angew. Chem. Int. Ed.*, 2014, 53, 6496-6500
Co_9S_8@MoS_2/CNFs	430	61	*Adv. Mater.*, 2015, 27, 4752-4759.
Crumpled graphene/CoO	420	75	*Energy Environ. Sci.*, 2014, 7, 609-615
Spinel Mn-Co oxides/CNTs	430	-	*J. Am. Chem. Soc.*, 2014, 136, 7551-7554
Co_xO_y/N-doped carbon	430	-	*Angew. Chem. Int. Ed.*, 2014, 53, 8508-8512
Monodisperse Co nanoparticles	390	-	*J. Am. Chem. Soc.*, 2015, 137, 7071-7074
CoO_x@CN	410	-	*J. Am. Chem. Soc.*, 2015, 137, 2688–2694
N-doped carbon/NiO_x	380	-	*Nat. Commun.*, 2013, 4, 2390
Mn_3Co_7-$Co_2Mn_3O_8$@CNTs/CNFs	370	66	This work

Table S3 The comparison of ORR activity among recently reported various electrocatalysts.

Catalysts	Onset potential (V)	Halfwave potential (V)	Tafel slope(mV dec^{-1})	n	Reference
PANI-Co-C	0.80	0.75	N/A	N/A	*Science*, 2011, 332, 443
Co_3O_4/N-rmGO	0.88	0.83	50	3.9	*Nat. Mater.*, 2011, 10, 780
ZIF-derived Co-NCNTs	0.87	0.84	93	3.99	*Nat. Energy*, 2016, 1, 15006
CNT/graphene hybrid	0.89	0.76	68	4	*Nat. Nanotech.*, 2012, 7, 394
P-doped ZIF8-derived carbons	0.90	0.71	-	4	*J. Am. Chem.*, Soc. 2014, 136, 14385
FeN_x/C catalyst	0.94	0.82	-	-	*J. Am. Chem.*, Soc. 2014, 136, 10882
Sulphur-doped graphene	0.88	0.66	-	3.13	*Angew. Chem. Int. Ed.*, 2015, 54,1888
Fe–N/C-800	0.92	0.80	-	3.96	*J. Am. Chem. Soc.*, 2014, 136, 1102
MOF-derived carbons	0.9	N/A	-	3.61	*Angew. Chem. Int. Ed.*, 2014, 53, 2433
N-doped carbon frameworks	0.79	0.79	-	3.95	*J. Am. Chem. Soc.*, 2013, 135, 16002
ZIF8-Te-1000	0.75	0.83	-	3.6	*J. Am. Chem. Soc.*, 2014, 136, 14385
Mn_3Co_7-$Co_2Mn_3O_8$@CNTs/CNFs	0.89	0.82	70	3.73	This work

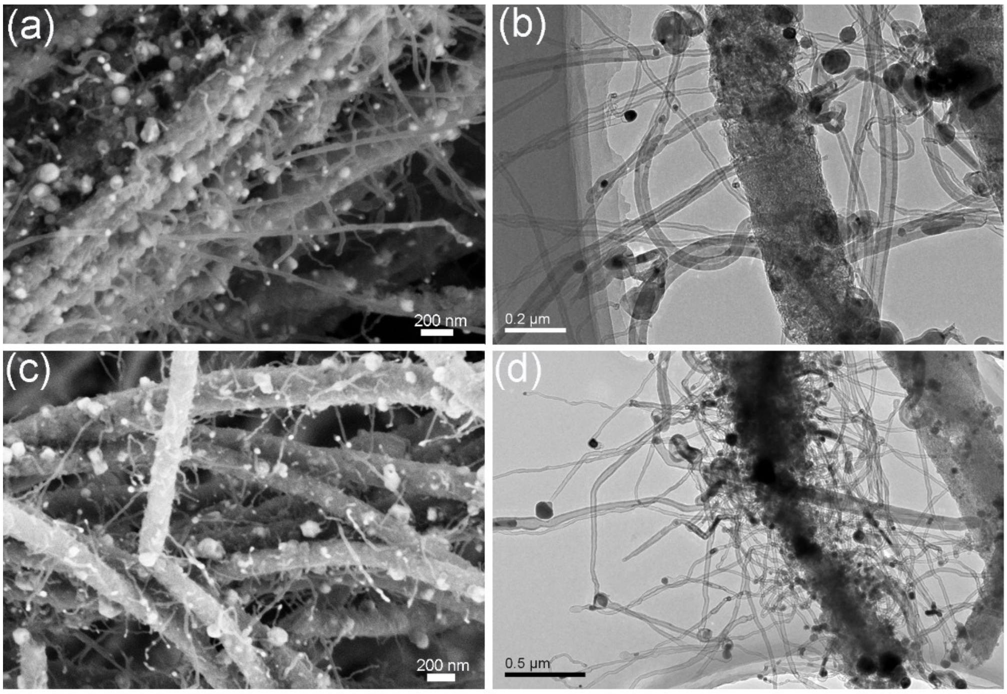

Figure S11 The FE-SEM and TEM images of the Mn_3Co_7-$Co_2Mn_3O_8$@CNTs/CNFs hybrid after HER and OER stability tests for 10 h, respectively.

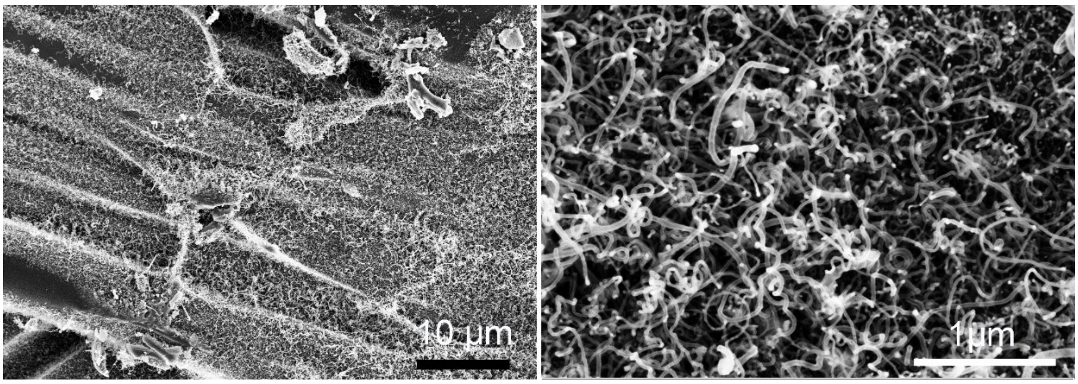

Figure S12 FE-SEM and TEM images of the silk fiber derived carbon fibers with branched CNTs using CoMnO as catalysts.