Supplementary Materials

1-D array of porous $Mn_{0.21}Co_{2.79}O_4$ nanoneedles with an enhanced electrocatalytic activity toward oxygen evolution reaction

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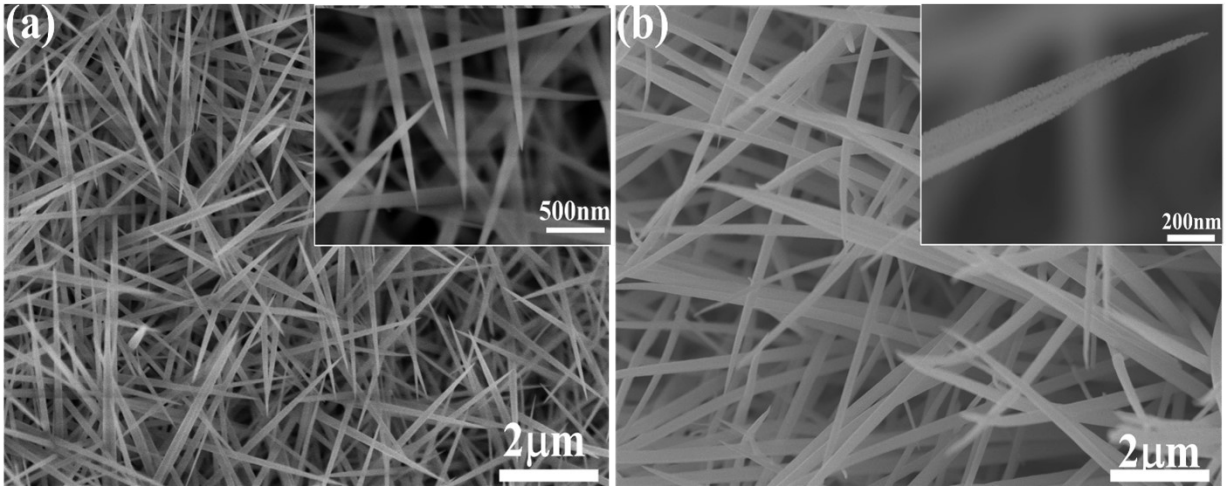

Figure S1. SEM images of (a) cobalt hydroxycarbonate (CHC) film and (b) Co_3O_4 (CO)film.

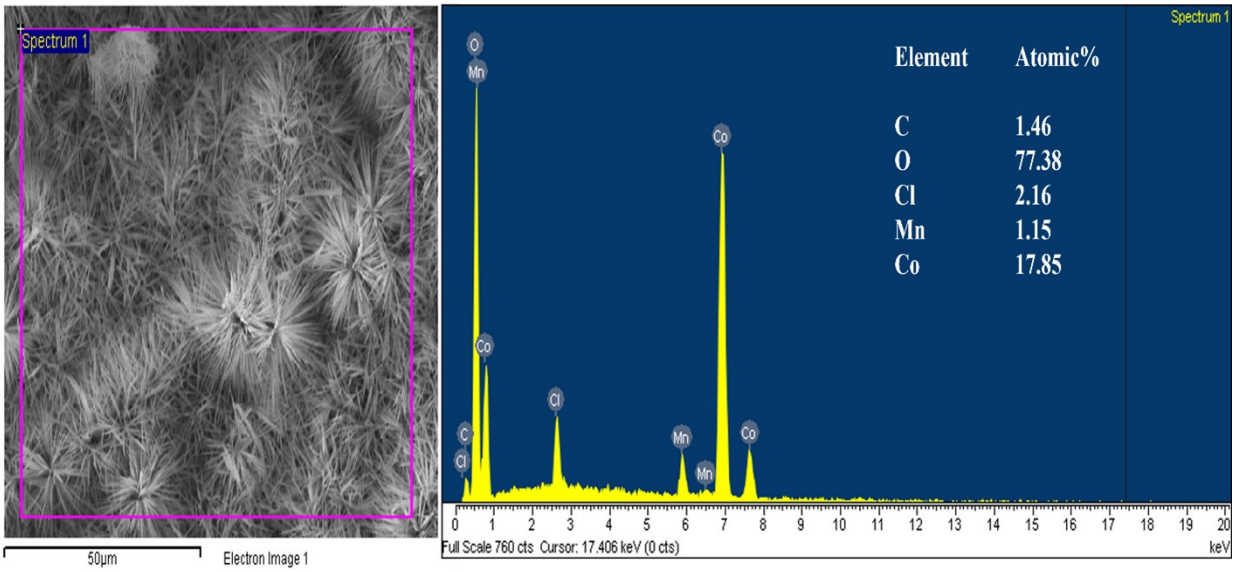

Figure S2. EDX spectrum of the MCHC film.

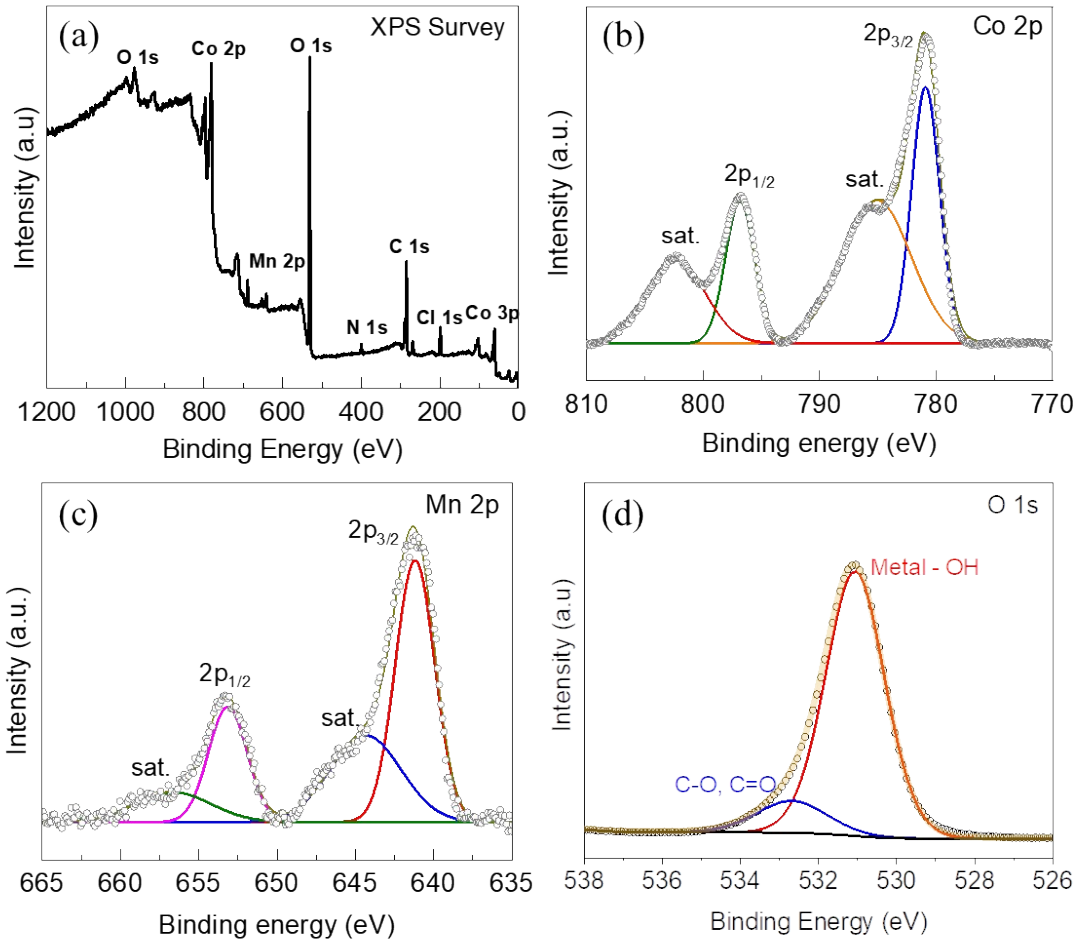

Figure S3. (a) XPS survey spectrum of the MCHC film, the corresponding high-resolution XPS spectrum of (b) Co 2p, (c) Mn 2p, and (d) O 1s.

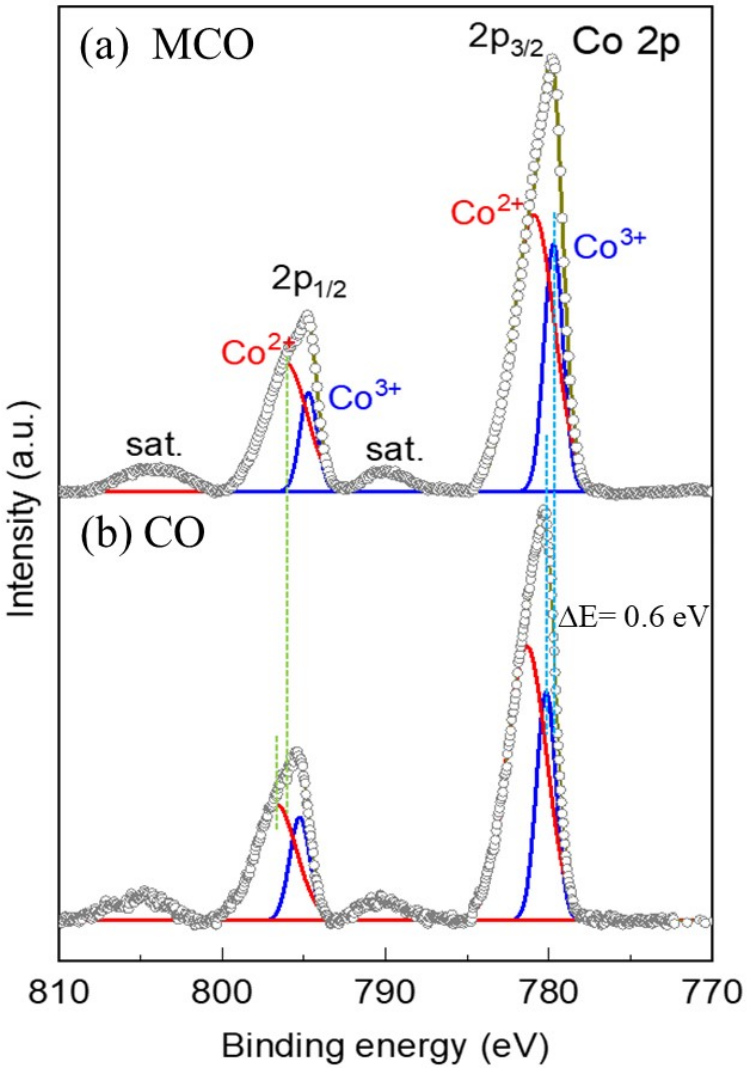

Figure S4. High-resolution Co 2p XPS spectra of (a) MCO, and (b) CO.

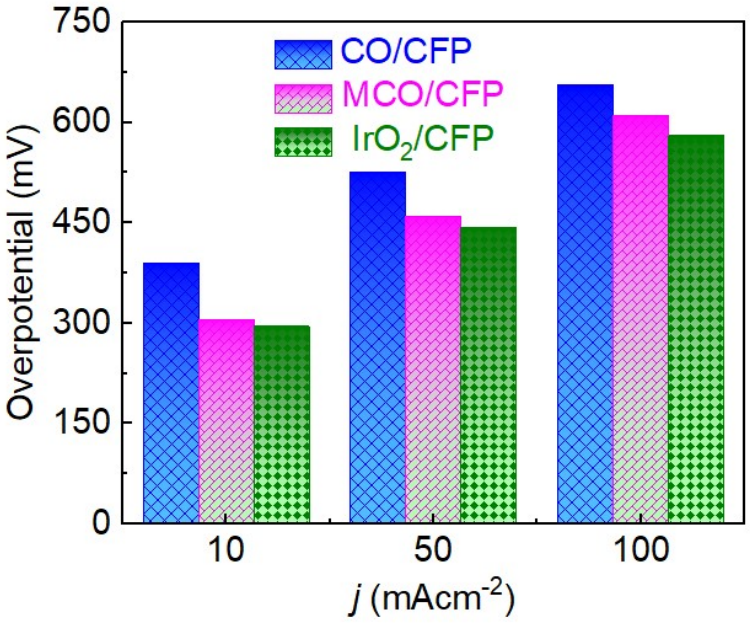

Figure S5. OER overpotential vs current density profile.

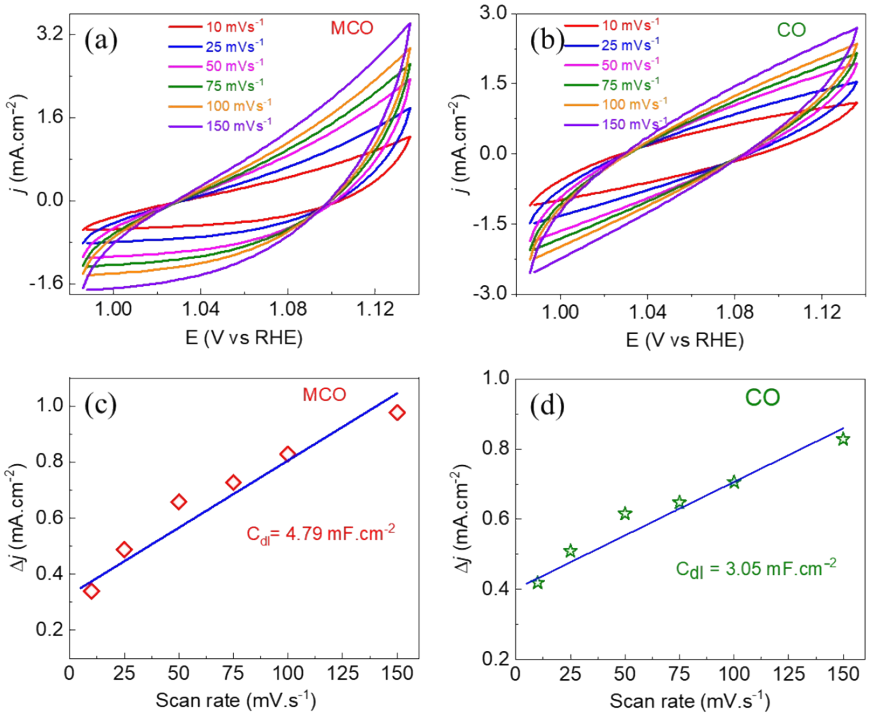

Figure S6. (a)-(b) Cyclic voltammograms of various electrodes in 1.0 M KOH aqueous electrolyte at different potential scanning rates ($m.Vs^{-1}$); (c)-(d) Linear plots obtained by plotting the average current density (Δj) vs potential scanning rates at 1.061V vs RHE .

Table S1. Comparison on OER overpotentials of various Co- and Mn-based oxides in alkaline aqueous electrolyte.

Catalyst	Preparation methods and conditions	Electrolyte	Overpotential (mV) @10 mA.cm^{-2}	Tafel slope mV. dec^{-1}	Reference
$Mn_{0.21}Co_{2.79}O_4$ nanoneedle/CFP	Hydrothermal and heat treatment at 350^{o}C 2h	1 M KOH	304	79	**This work**
Co_3O_4-nanoneedle/CFP	Hydrothermal and heat treatment at 350^{o}C 2h	1 M KOH	390	108	**This work**
IrO_2/CFP		1 M KOH	295	73	**This work**
MnCoO-cuboid/CFP	topotactic-hydrothermal reaction, 120^{o}C	1 M KOH	350	74	*Chem. Commun*. 2021, 57, 3595
$Mn_xCo_{3-x}O_4$-nanochain/FTO	microemulsion method and thermal treatment at 400-550 ^{o}C	1 M KOH	320		*Chem. Commun*. 2017,53, 8018
Co_3O_4/FTO	microemulsion method and thermal treatment at 400-550 ^{o}C	1 M KOH	360		*Chem. Commun*. 2017,53, 8018
RuO_2/FTO	Commercial/ electrophoretic deposition	1 M KOH	410		*Chem. Commun*. 2017,53, 8018
Mn_2O_3	microemulsion method and thermal treatment at 400-550 ^{o}C	1 M KOH	560		*Chem. Commun*. 2017,53, 8018
Co_3ZnC/Co@CN	one-step annealing of Prussian blue analogues	1 M KOH	366	81	*J. Mater. Chem. A*, 2016, 4, 9204
Co_3O_4	Co-precipitation	1 M KOH	497		*ChemSusChem*, 2011, 4, 1566
CoO_x/Black NTA	Dip coating and thermal treatment at 450 ^{o}C	1M KOH	352	65	*ACS Catal.* 2018, 8, 5, 4278
CoFeOx	Electrodeposition	1M NaOH	360		*J. Am. Chem. Soc*. 2013, 135, 16977
$Co(OH)_2$	Electrochemical etching and phase	1M KOH	325	55	*J. Mater. Chem. A*, 2016,

	change				4, 9578
Co_3O_4/N-rmGO	Hydrothermal	1 M KOH	320	67	*Nat. Mater*. 2011, 10, 780
CoMn LDH	one-pot co-precipitation method	1 M KOH	324	49	*J. Am. Chem. Soc*. 2014, 136, 16481
MnOx	solution synthesis	1M KOH	573	49	*J. Am. Chem. Soc*. 2012, 134, 17253