Electronic Supplementary Information for

Hybrid atoms-doped $NiMoO_4$ nanotube for oxygen evolution reaction

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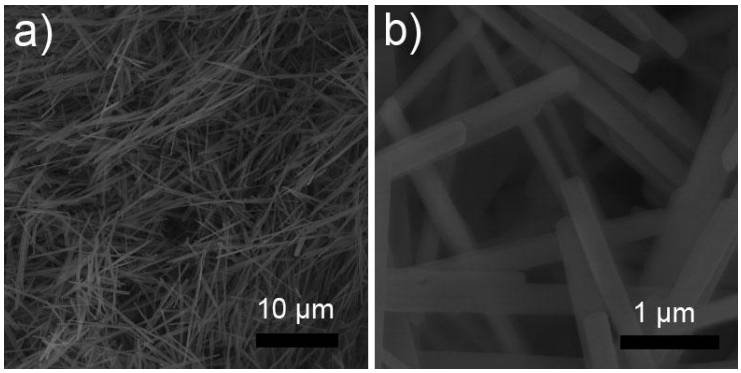

Figure S1 Structural characterization of the MoO_3 nanowires. a) SEM image, b) low-magnifcation and high-magnifcation TEM images

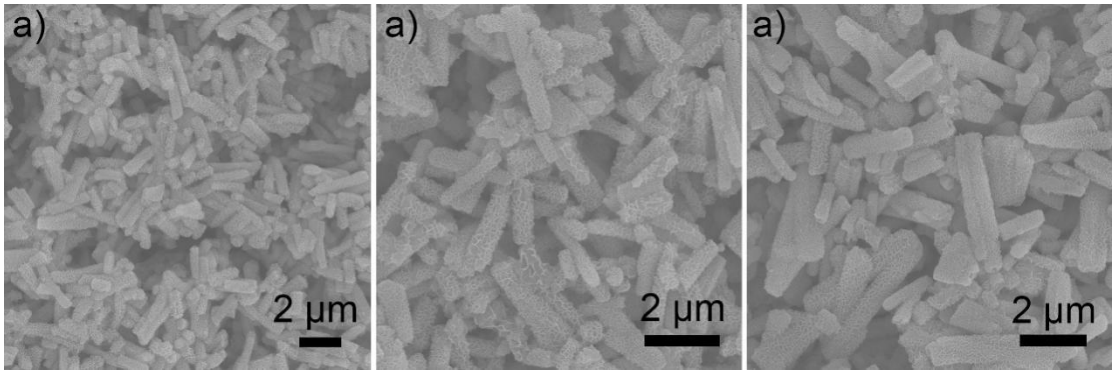

Figure S2 SEM images of a) Co-$NiMoO_4$, b) Fe-$NiMoO_4$ and c) Mn-$NiMoO_4$.

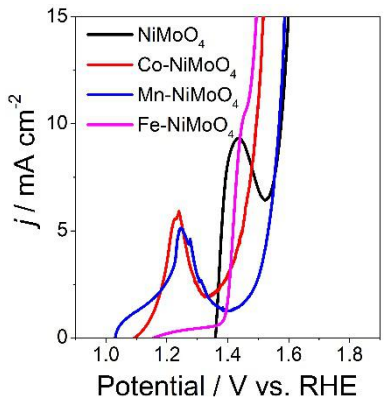

Figure S3 The polarization curves of $NiMoO_4$、$Co\text{-}NiMoO_4$、$Mn\text{-}NiMoO_4$ and $Fe\text{-}NiMoO_4$ toward the OER.

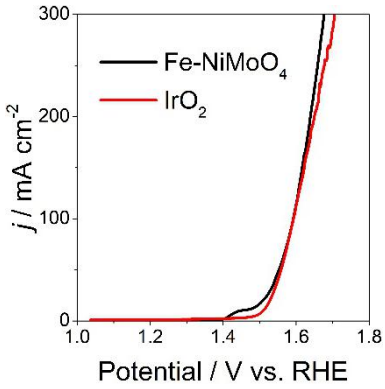

Figure S4 Polarization curves of $Fe\text{-}NiMoO_4$ and IrO_2 catalysts at a scan rate of 2 mV s^{-1} in 1 M KOH

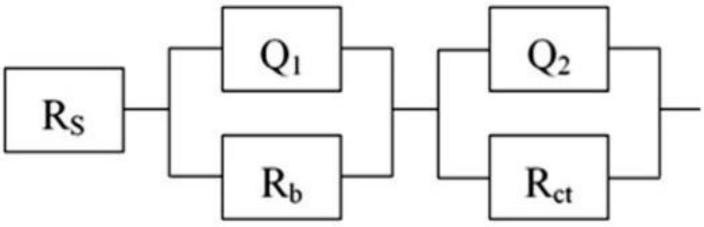

Figure S5 The equivalent circuit for Nyquist plots of the nanotubes electrodes

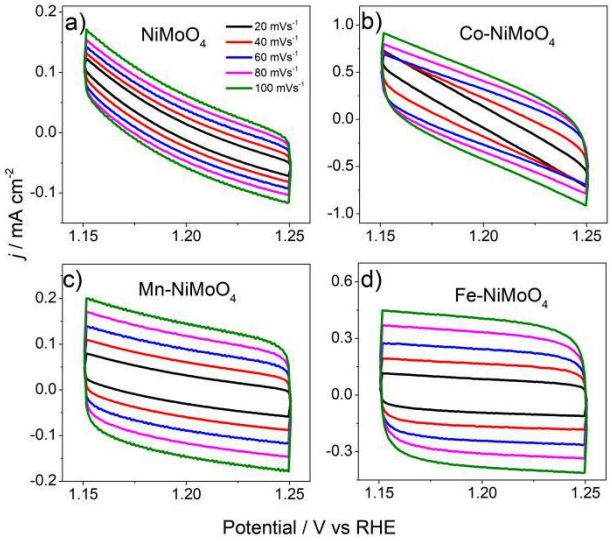

Figure S6 The cyclic voltammograms curves of nanotubes a) $NiMoO_4$, b) Co-$NiMoO_4$, c) Mn-$NiMoO_4$ and Fe-$NiMoO_4$.

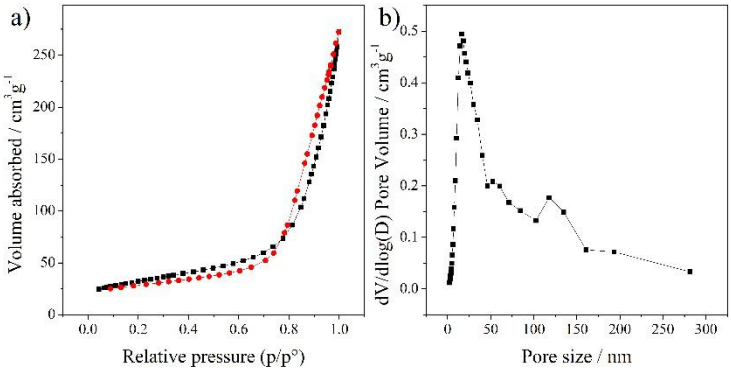

Figure S7 a) Nitrogen adsorption and desorption isotherms and b) the corresponding pore-size distribution calculated by BJH method from the desorption branch of hierarchical nanosheet-based $NiMoO_4$ nanotubes

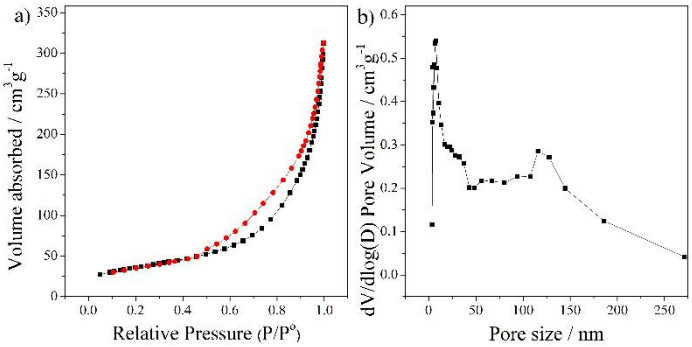

Figure S8 a) Nitrogen adsorption and desorption isotherms and (b) the corresponding pore-size distribution calculated by BJH method from the desorption branch of hierarchical nanosheet-based Co-$NiMoO_4$ nanotubes

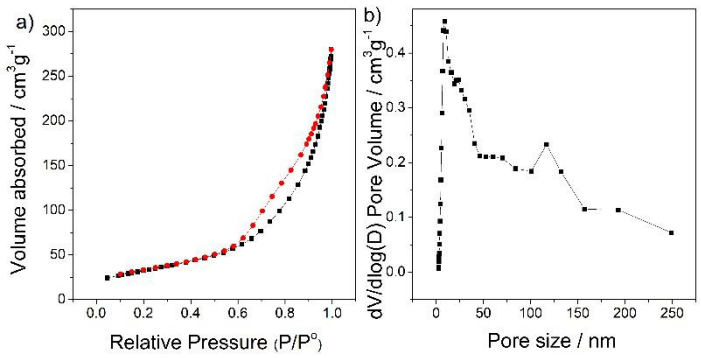

Figure S9 a) Nitrogen adsorption and desorption isotherms and (b) the corresponding pore-size distribution calculated by BJH method from the desorption branch of hierarchical nanosheet-based Mn-$NiMoO_4$ nanotubes

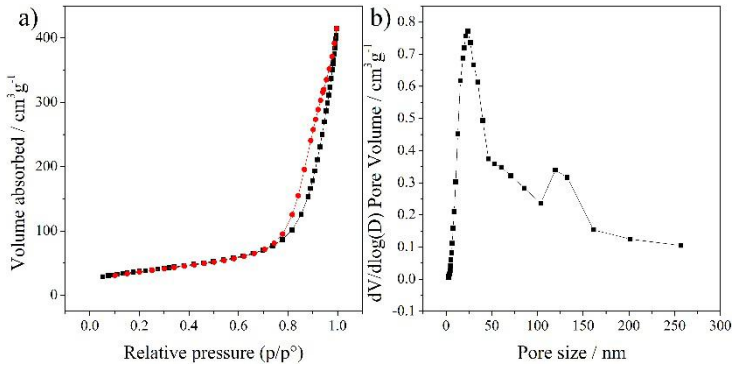

Figure S10 a) Nitrogen adsorption and desorption isotherms and (b) the corresponding pore-size distribution calculated by BJH method from the desorption branch of hierarchical nanosheet-based Fe-$NiMoO_4$ nanotubes

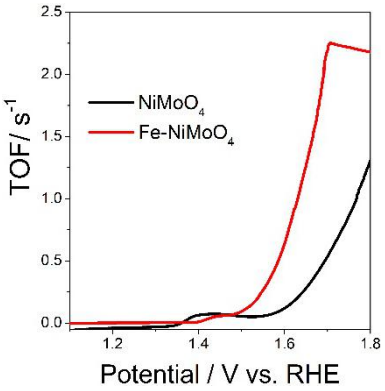

Figure S11 The OER TOFs of the $NiMoO_4$ and Fe-$NiMoO_4$

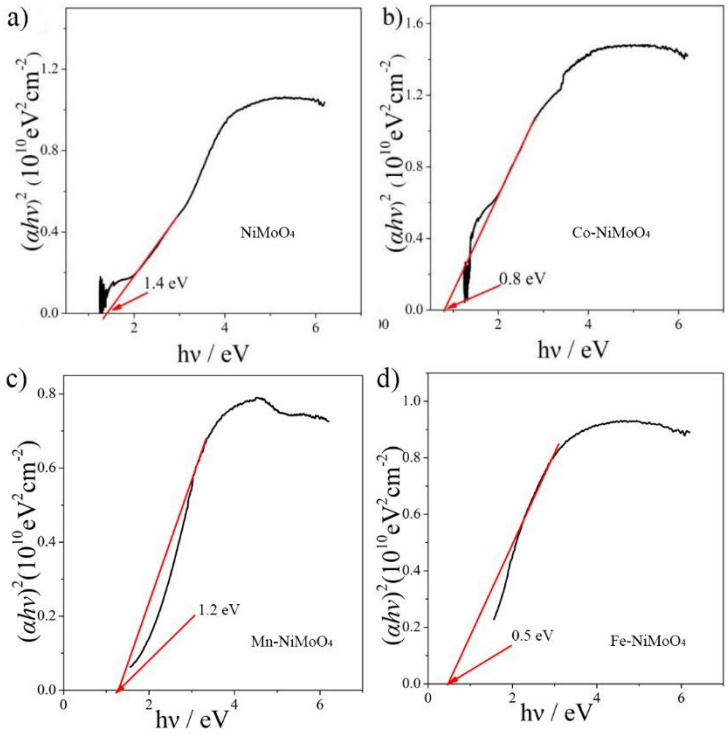

Figure S12 The kubelka-munk plot for band gap energy of a) $NiMoO_4$, b) Co-$NiMoO_4$, c) Mn-$NiMoO_4$ and d) Fe-$NiMoO_4$.

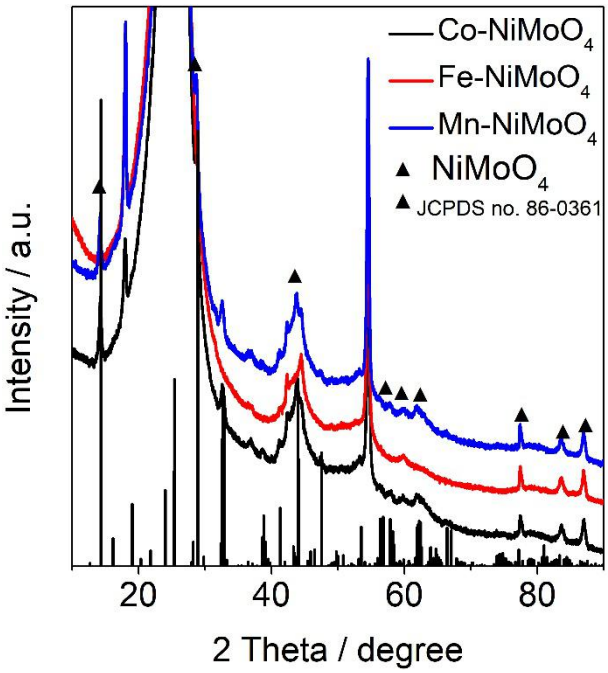

Figure S13 XRD patterns of after the OER process for Co-$NiMoO_4$, Fe-$NiMoO_4$ and Mn-$NiMoO_4$

Table S1. The detailed parameters of $NiMoO_4$、 Co-$NiMoO_4$、 Mn-$NiMoO_4$ and Fe-$NiMoO_4$ toward the OER.

	$NiMoO_4$	**Co-$NiMoO_4$**	**Mn-$NiMoO_4$**	**Fe-$NiMoO_4$**
Hybrid atom/Ni	----	10/90	5/95	15/85
Overpotential at 10 mA cm^{-2}	340 mV	270 mV	330 mV	217 mV
anodic peak position	1.43 V vs. RHE	1.23 V vs. RHE	1.25 V vs. RHE	--
Rct	1.6 Ω cm^2	1.3 Ω cm^2	1.4 Ω cm^2	1.2 Ω cm^2
Cdl	O.59 mF cm^{-2}	3.9 mF cm^{-2}	3.9 mF cm^{-2}	3.9 mF cm^{-2}
surface area	105 m^2 g^{-1}	123 m^2 g^{-1}	112 m^2 g^{-1}	131 m^2 g^{-1}
bandgap	1.4 eV	0.8 eV	1.2 eV	0.5 eV

Table S2. Comparison of OER activity of the Hybrid metal atoms-doped $NiMoO_4$ nanotubes with recently reported catalyst.

Catalysts	**Overpotential at 10 mA cm^{-2} (mV vs RHE)**	**Electrolyte concentration (pH)**	**Ref.**
$NiMoO_4$	340	14	This work
Fe-$NiMoO_4$	217		
Co-$NiMoO_4$	270		
Mn-$NiMoO_4$	330		
$Ni(OH)_2$	300	14	7
α-$Ni(OH)_2$	331	14	13
$Ni(OH)_2$ films	280	14	14
$Co(OH)_2$	450	13	16
$NiMoO_4$	＞344	14	17
$NiMoO_4$	372	14	18
NiO@MoO_3/VC	280	14	19
NiMoP@CoCH/CC-2	＞270	14	20
$NiMoO_{4-x}/MoO_2$	233	14	22
P-$NiMoO_4$	310	14	23
α-$CoMoO_4$	430	14	24
Co_3O_4@$NiMoO_4$	＞300	14	25

CeO_2/FeOOH HLNTs-NF electrocatalyst	220	14	27
FeOOH/Co/FeOOH HNTAs-NF	220	14	28
Hierarchical CoO_x nanosheet/nanotube	＞230	14	29
Co_4Ni_1P NTs	245	14	30
Co@Co_3O_4/NC-1	410	14	33
NCNT/CoO NiO-NiCo	270	14	35
Ni_3FeN-NPs	280	14	37
$Ni_{0.9}Fe_{0.1}Ox$	336	14	38
$CoMoO_4$–$NiMoO_4$	300	14	40
$Ni_{0.69}Co_{0.31}$–P	266	14	41
$NiCo_2O_4$	255	14	43
NiMn LDHs	350	14	44
NiMoN-550	312	14	49
Ni-Fe-MoN NTs	228	14	50
Co-NiMoN NRs	294	14	51
NiMoN/NF-450	270	14	52
Mo_2C@NC/Co@NG-900	420	14	53