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Supporting Information

Superior oxygen evolution reaction performance of NiCoFe spinel oxide nanowires in-situ grown on β-$Ni(OH)_2$ nanosheets-decorated Ni foam: case studies on stoichiometric and off-stoichiometric oxides

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Tables S1, S2, S3 and S4.

Figures S1, S2 and S3

Table S1. Sample codes with the respective NiCoFe Sample

S. No.	NiCoFe camples	Sample codes	Hetero-structure sample codes (*)
1.	$NiCo_{2-x}Fe_xO_4$	N1C11; for x = 0.125 N1C12; for x = 0.25	N1C11@NiO@NF N1C12@NiO@NF
2.	$Ni_{0.75}Co_{2.25-x}Fe_xO_4$	N2C21; for x = 0.125 N2C22; for x = 0.25	N2C21@NiO@NF N2C22@NiO@NF (*) : NiO@NF is the β-$Ni(OH)_2$ decorated Nickel foam annealed at 350^oC

Table S2. Results of the fit of the Ni 2p X-ray Photoelectron Spectra for N1C12@NiO@NF and N2C22@NiO@NF electrocatalysts

Sample	Parameter	Spin-Orbit Doublet I		Spin-Orbit Doublet II	
		Ni $2p_{3/2}$	Ni $2p_{1/2}$	Ni $2p_{3/2}$	Ni $2p_{1/2}$
N1C12@NiO@NF	Eg (eV)	854.3	871.9	855.8	873.6
	fwhm (eV)	1.4	2.0	3.3	3.0
	$area_{rel}$ (%)	18		82	
	assignment	Ni^{2+}		Ni^{3+}	
N2C22@NiO@NF	Eg (eV)	854.1	871.6	855.9	873.3
	fwhm (eV)	1.4	1.8	3.1	3.1
	$area_{rel}$ (%)	26		74	
	assignment	Ni^{2+}		Ni^{3+}	

Table S3. Results of the fit of the Co 2p X-ray Photoelectron Spectra for N1C12@NiO@NF and N2C22@NiO@NF electrocatalysts

Sample	Parameter	Spin-Orbit Doublet I		Spin-Orbit Doublet II	
		Co $2p_{3/2}$	Co $2p_{1/2}$	Co $2p_{3/2}$	Co $2p_{1/2}$
N1C12@NiO@NF	Eg (eV)	779.5	794	781	796.4
	fwhm (eV)	1.9	1.9	3.4	3.0
	$area_{rel}$ (%)	33		67	
	assignment	Co^{3+}		Co^{2+}	
N2C22@NiO@NF	Eg (eV)	779.7	794.9	781.4	796.6
	fwhm (eV)	2.4	1.9	3.4	2.8
	$area_{rel}$ (%)	51		49	
	assignment	Co^{3+}		Co^{2+}	

Table S4. Comparison of OER performance with previously reported NiCo-based electrocatalysts

Electrocatalysts	Electrolyte	Overpotential, η (mV)	Tafel Slope (mV/dec)	Ref.
NiCo oxides	1 M KOH	340 at 10 mA/cm^2	51	S1
r$NiCo_2O_4$/Ni	0.1 M KOH	379 at 10 mA/cm^2	63.4	S2
NiO/$NiCo_2O_4$@3DPNN	1M KOH	264 at 10 mA/cm2	79	S3
CoNi/$CoFe_2O_4$/NF	1M KOH	290 at 100 mA/cm^2	45	S4
NiCoFe@NiCoFeO NTAs/CFC	1M KOH	201 at 10 mA/cm^2	39	S5
Ni−Fe LDHs	1M KOH	297 at 100 mA/cm^2	60.8	S6
$NiCo_2O_4$ hollow microcuboids	1 M NaOH	290 at 10 mA/cm^2	53	S7
Wire-like MoS_2/rFe-$NiCo_2O_4$	1M NaOH	270 at 10 mA/cm^2 320 at 100 mA/cm^2	39	S8
$NiCo_{2-x}Fe_xO_4$ NBs	1 M KOH	274 at 10 mA/cm^2 290 at 30 mA/cm^2	42	S9
Co_3O_4/Co-Fe oxide	1 M KOH	297 at 10 mA/cm^2	61	S10
NiCoFe/NF/$FeSO_4$	1 M KOH	293 at 100 mA/cm^2	48.3	S11
B-NiCoFe (NiCoFe spinel oxide grown on Fe surface)	1 M KOH	342 at 10 mA/cm^2 500 at 110.5 mA/cm^2	48	S12
Ni-Co_3O_4NS\NF	1 M KOH	310 at 10 mA/cm^2 390 at 100 mA/cm^2	59.5	S13
FeNi@FeNi	1 M KOH	193 at 10 mA/cm^2 231 at 20 mA/cm^2 306 at 50 mA/cm^2	143.1	S14

Fe-NiCo-MOF/NF	1 M KOH	290 at 50 mA/cm^2 326 at 100 mA/cm^2 373 at 200 mA/cm^2	96.9	S15
$W_{0.5}Co_{0.4}Fe_{0.1}$/NF	1 M KOH	250 at 10 mA/cm^2 310 at 100 mA/cm^2	32	S16
Co_3O_4/$NiCo_2O_4$/Ni foam	0.1 M KOH	320 at 10 mA/cm^2	84	S17
NiO/$NiCo_2O_4$ nanofibres	1 M KOH	357 at 10 mA/cm^2	130	S18
NiCoFe-LDHs nanosheets	1 M NaOH	288 at 10 mA/cm^2	92	S19
$NiCo_{1.75}Fe_{0.25}O_4$@NiO@NF	1 M KOH	272 at 100 mA/cm^2	54	This work
$Ni_{0.75}Co_2Fe_{0.25}O_4$@NiO@NF	1M KOH	292 at 100 mA/cm^2	66	This work

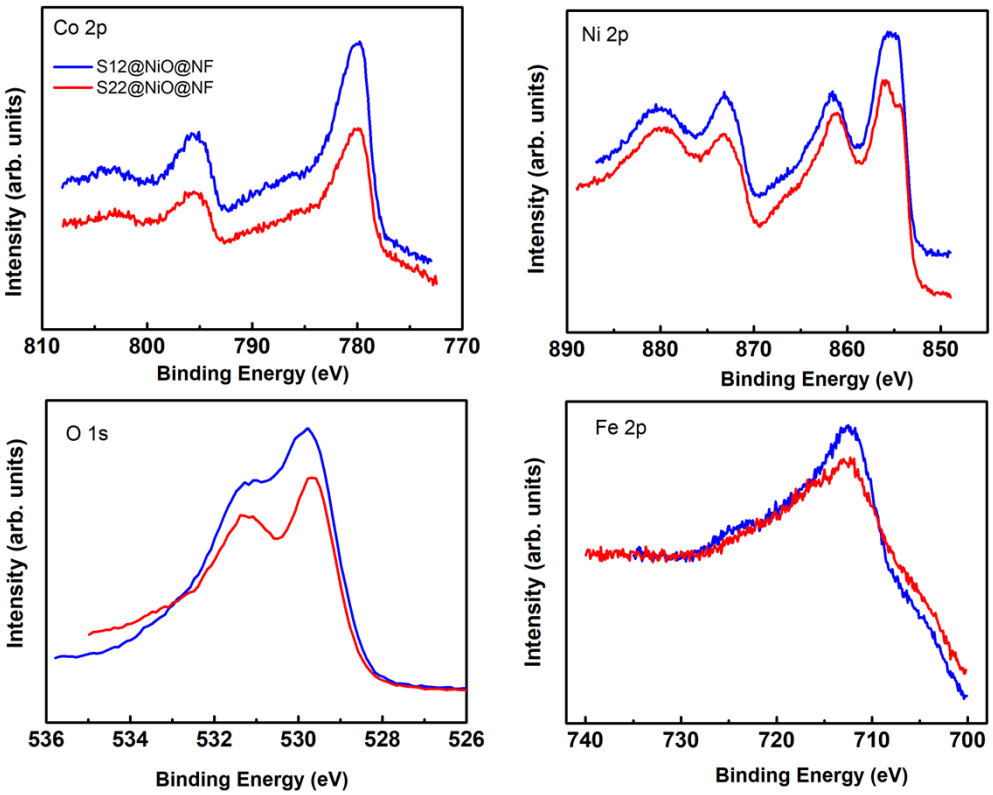

Figure S1. A comparison of the XPS peaks for N1C12@NiO@NF (blue plots) and N2C22@NiO@NF (red plots).

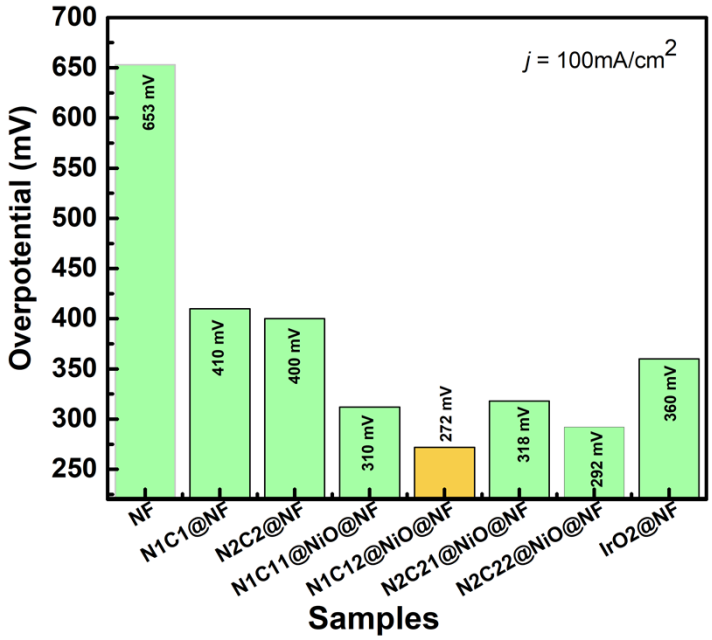

Figure S2: Comparison of overpotential values of different *electrocatalysts at a current density of 100 mA/cm² .*

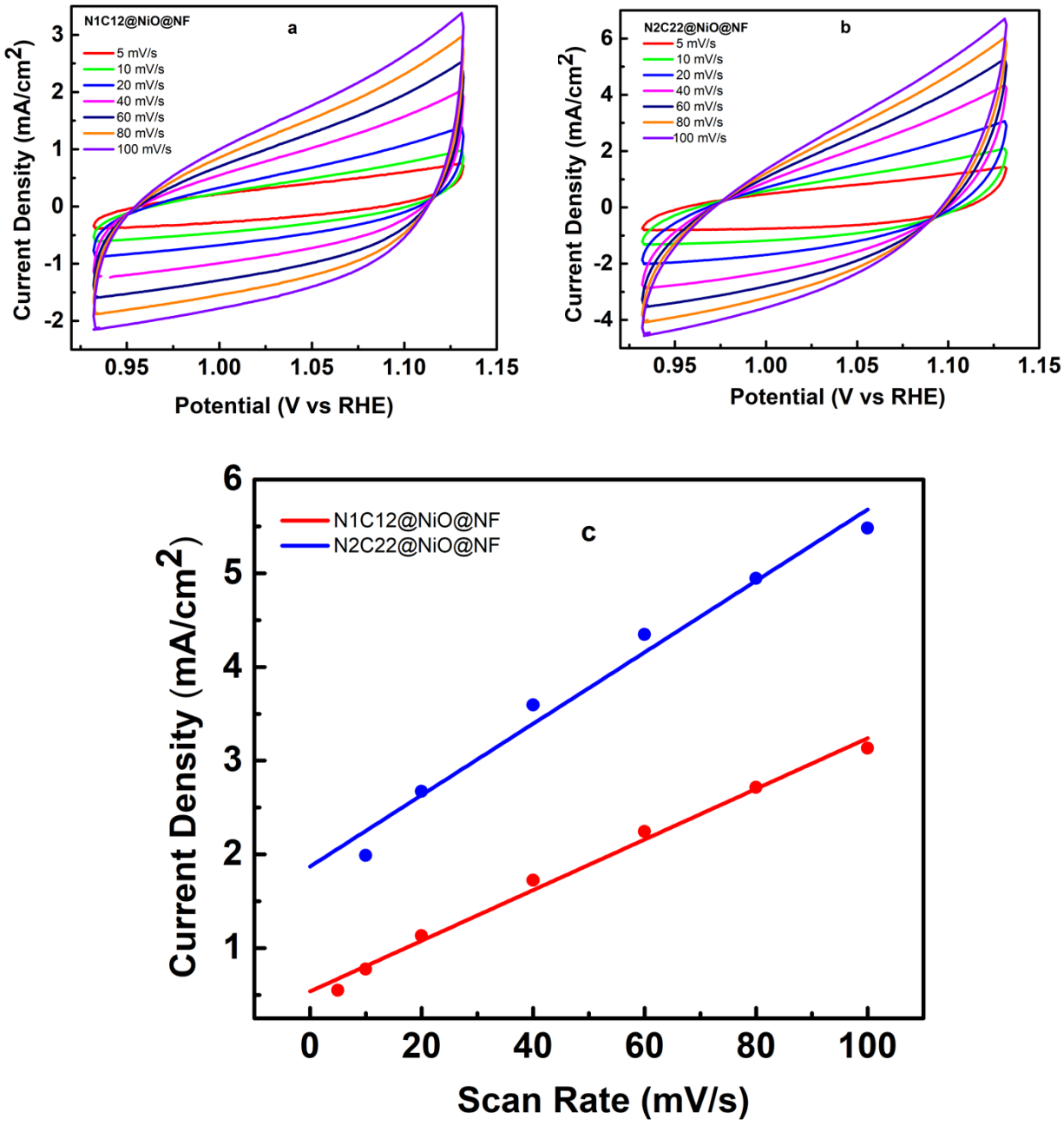

Figure S3: Cyclic Voltammetry (non-faradaic region, measured at the potential window from 0.932 to 1.132 V (vs RHE)) curves for N1C12@NiO@NF (a) and N2C22@NiO@NF (b) with different scan rates and the relationship between the current density at the potential of 1.035 V vs RHE and scanning rates (c).

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