Supporting Information

α and β–motifs Interstratified β_{bc}–Nickel Hydroxide for Enhanced OER and UOR Electrocatalysis

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DIFFaX simulation

The structure parameters of β–nickel hydroxide were obtained from JCPDS-PDF 003-0177. Hydrogen atoms and the intercalated anions were not included in the calculation. A Lorentzian peak broadening of 0.5° was employed to account for the instrumental broadening and the other unaccounted causes. A platelet thickness of ~10 nm (20 layers in registry) was assumed and the percentage of α–motifs was varied from 0 to 20. The best fit was found for 12% α–motifs.

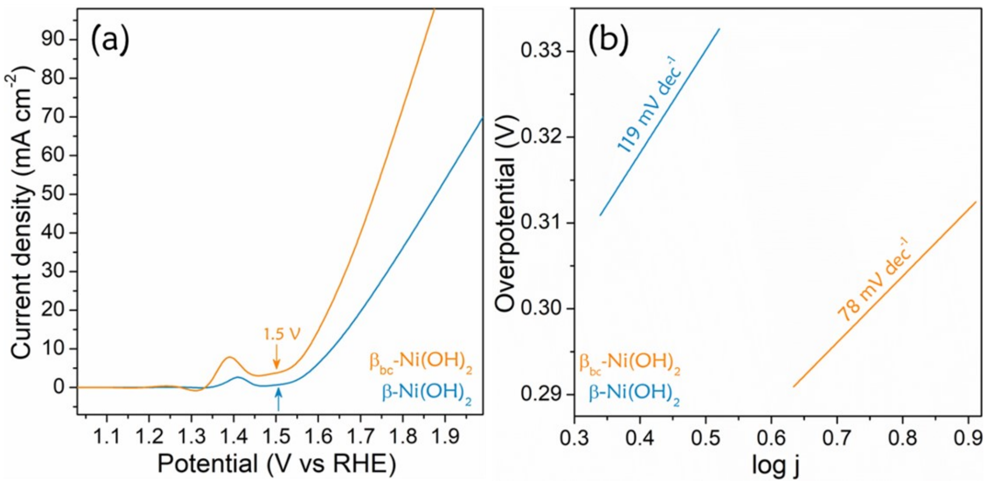

Figure S1 Data without IR correction: (a) LSV and the corresponding (b) Tafel plot (η vs log j) of β–nickel hydroxide and β_{bc}–nickel hydroxide recorded at a scan rate of 1 mV s^{-1} respectively in 1M KOH.

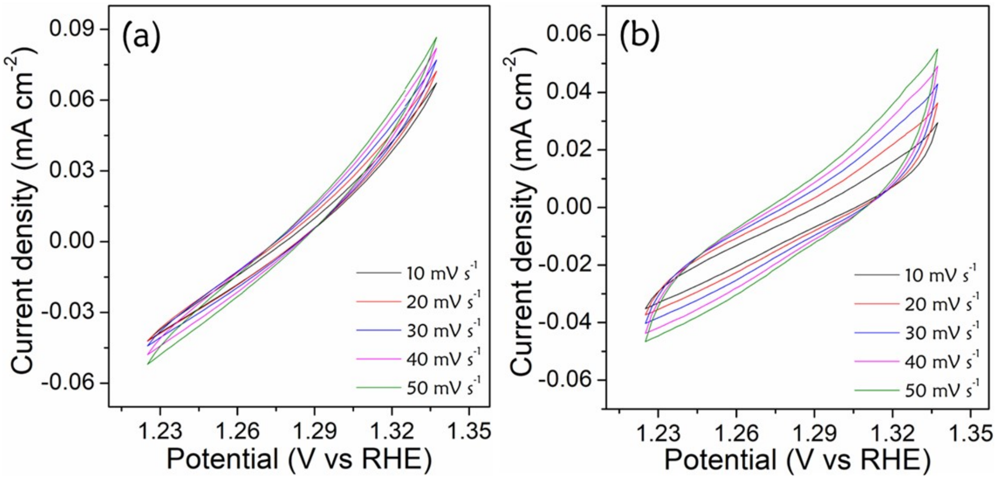

Figure S2 Cyclic voltammograms of (a) β–nickel hydroxide and (b) β_{bc}–nickel hydroxide recorded at various scan rates in 1 M KOH. This data was used to estimate the electrochemical surface area (ECSA) of the electrode materials.

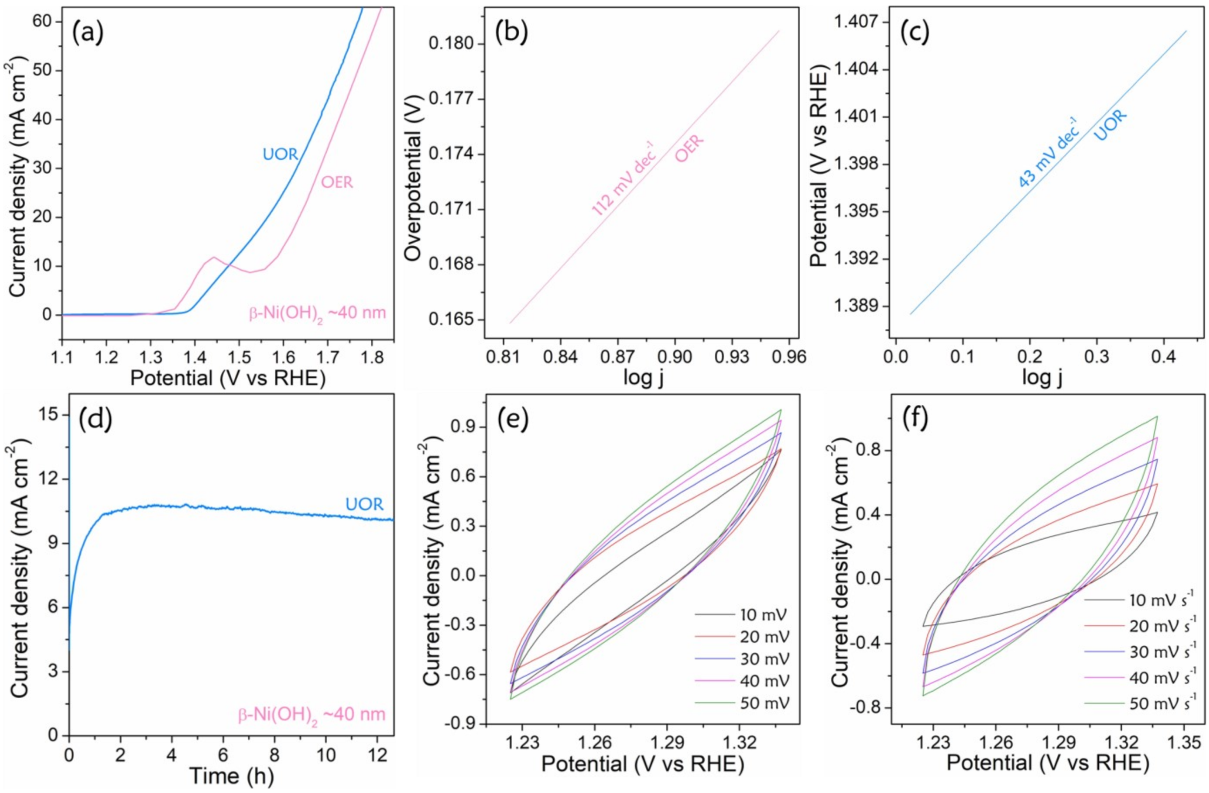

Figure S3 Electrochemical studies of ~40 nm β–nickel hydroxide obtained by hydrothermal treatment of β_{bc}–nickel hydroxide in 0.2 M KOH for 12h. LSV @ 5 mV s^{-1} in 1 M KOH without urea (OER) and with 0.33 M urea (UOR) (a); Tafel plot (η vs log j) (b and c); Chronoamperometry (j vs t) at an applied potential of 1.4 V_{RHE} in 1 M KOH + 0.33 M urea (UOR) (d); Cyclic voltammograms at various scan rates in 1 M KOH (OER) (e) and 1 M KOH + 0.33 M urea (UOR) (f). This data was used to estimate the electrochemical surface area (ECSA) of the electrode material.

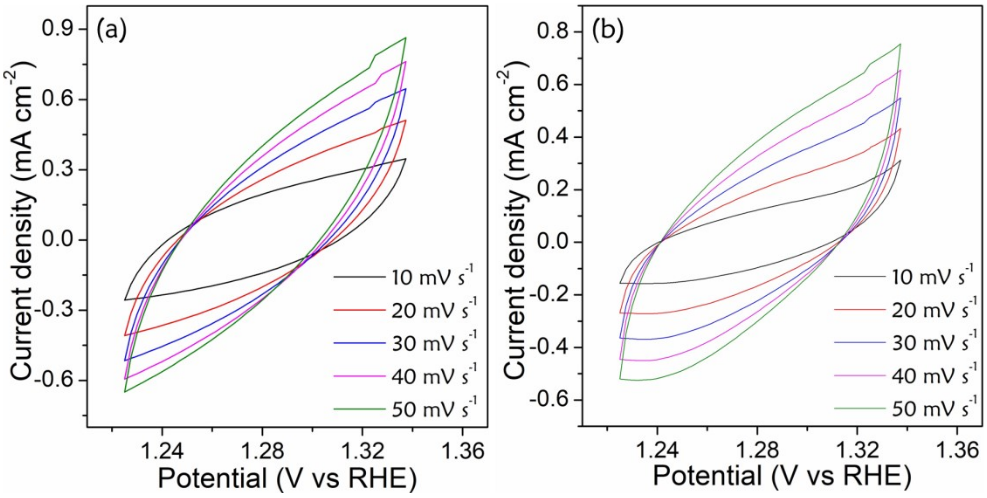

Figure S4 Cyclic voltammograms of (a) β–nickel hydroxide and (b) β_{bc}–nickel hydroxide recorded at various scan rate in 1M KOH + 0.33 M urea. This data was used to estimate the electrochemical surface area (ECSA) of the electrode materials.

Table S1 Comparison of the electrocatalytic OER activity of various nickel hydroxide-based materials reported in the literature.

Catalyst	**OER: η_{10} (mV)**	**Tafel slope** (mV/dec)	**Ref**
β_{bc}-$Ni(OH)_2$	320	60	this work
β-$Ni(OH)_2$	370	95	
α-$Ni(OH)NO_3$ hollow spheres	331	42	1
β-$Ni(OH)_2$ hexagonal plates	444	111	
CNT/ultra-thin β-$Ni(OH)_2$ nanoplate	474	87	2
Ultrathin β-$Ni(OH)_2$	470	60	3
Ultrathin β-$Ni_{0.78}Fe_{0.22}(OH)_2$	320	35	
β-$Ni(OH)_2$ films	421	58	4
rGO-β-$Ni(OH)_2$	378	56	
Electrodeposited $Ni(OH)_2$ on CNT	358	-	5
$CoNi(OH)_2$ Nanoflowers @V_2O_5	350	108	6
Ultrathin $Ni(OH)_2$ nanosheet	330	41	7
β-NiS@β-$Ni(OH)_2$	330	53	8
NiV-LDH	318	50	9
Ni/$Ni(OH)_2$ Hybrid	310	75	10
Electrodeposited α-$Ni(OH)_2$ on Ti	310	42.6	11
β-$Ni(OH)_2$ nanoparticles	300	53	12
NiFe−dodecyl sulfate LDH	318	80	13
NiFe−dodecyl sulfate LDH	300	36	14
NiFe LDH nanosheets	300	40	15
$Ni(OH)_2$	290	123.5	16
Sn-$Ni(OH)_2$	246	65.5	
$CoFe_2O_4$/β-$Ni(OH)_2$	278	67	17
β-Fe-$Ni(OH)_2$	260	32	18
NF/$NiMoO_4$/NiS/$Ni(OH)_2$	260	110	19
Yolk–Shell α/β-$Ni(OH)_2$/Carbon	254	55	20
β-Fe-$Ni(OH)_2$/nickel foam	219	53	21
β-$Ni(OH)_2$ nanoribbon	210	74	22

Ultrathin α-$Ni(OH)_2$/Ni Foam	192	108	23

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Table S2: Comparison of the electrocatalytic UOR activity of various nickel hydroxide-based materials reported in the literature.

Catalyst	**Onset (mV)**	**Potential (mV) @ 10mA cm^{-2}**	**Tafel slope** (mV/dec)	**Ref**
β_{bc}-$Ni(OH)_2$	1.36	1.39	25	this work
Ultrathin $Ni(OH)_2$ nanoflakes	1.37	1.41	36	1
$Ni(OH)_2$/CuCo/$Ni(OH)_2$ @ Ni foam	1.23	1.33	92	2
1% Ce:**α**-$Ni(OH)_2$/NF	1.29	1.31	25	3
1% Ce:β-$Ni(OH)_2$/NF	1.31	1.35	52	
$Ni(OH)_2$ nanosheets @ Carbon Cloth	1.31	1.32	81	4
Single layer α-$Ni(OH)_2$ @ Carbon Cloth	1.37	1.39	-	5
Oxygen vacancy rich V-$Ni(OH)_2$	1.36	1.38	29	6
vanadium doped α-$Ni(OH)_2$	1.31	1.33	32	7
Metallic $Ni(OH)_2$ nanosheets	1.37	1.39	-	8
V_{Ni} rich α-$Ni(OH)_2$	1.37	1.39	30	9
$Ni(OH)_2$@ Nickel Foam	1.34	1.35	24	10
α-nickel hydroxy chloride	1.32	1.34	41	11
β-$Ni(OH)_2$	1.35	1.38	74	
1% Cu:**α**-$Ni(OH)_2$/NF	1.31	1.34	38	12
Ni(OH)S	1.31	1.34	52	13
NiCo-LDHs	1.35	1.37	-	14
β-$Ni(OH)_2$ -NF	1.33	-	122	15
α-$Ni(OH)_2$/NF	1.33	-	61	
Co-$Ni(OH)_2$/NF	1.30	1.35	24	
Porous $Ni(OH)_2$ nanosheets	1.42	1.45	43	16
Ru nanoparticles – V doped NiFe LDH	1.37	1.4	-	17

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