

Supporting Information

Ni/NiO@NC as a high efficiency and durable HER electrocatalyst derivated from Nickel(II) complexe: the importance of polydentate amino acid ligand

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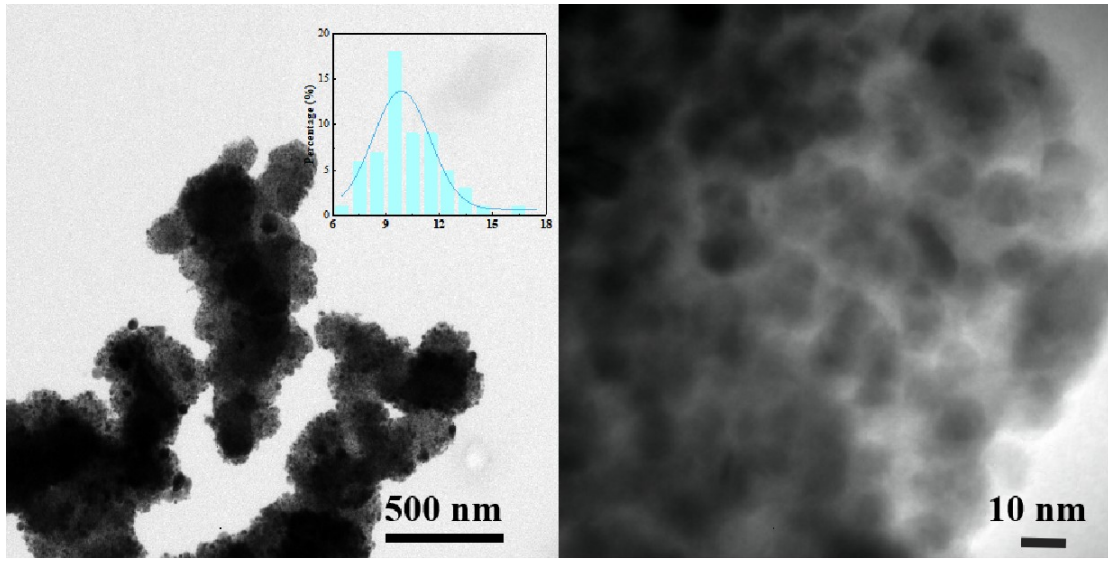


Fig. S1 (a) TEM images of Ni/NiO/C-Acrylic acid

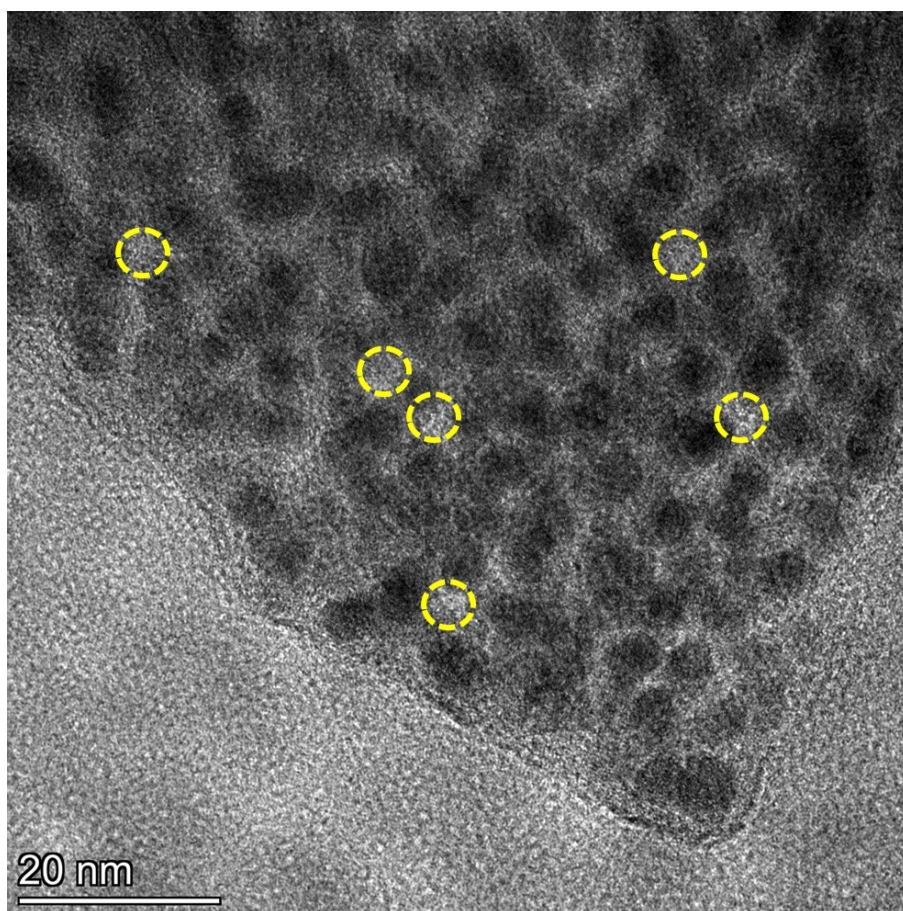


Fig. S2 TEM image of Ni/NiO@NC-540 .

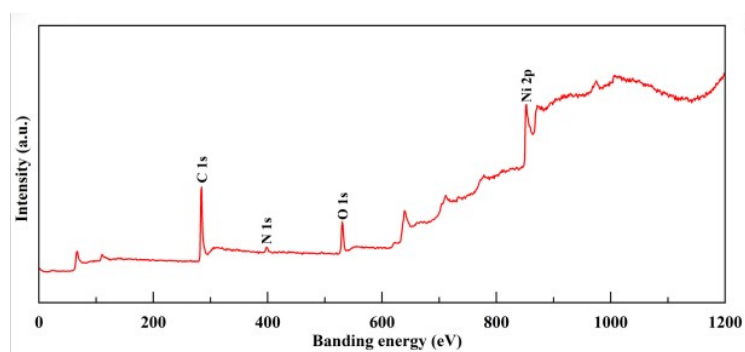


Fig. S3 The full scan of the XPS spectrum of Ni/NiO@NC-540

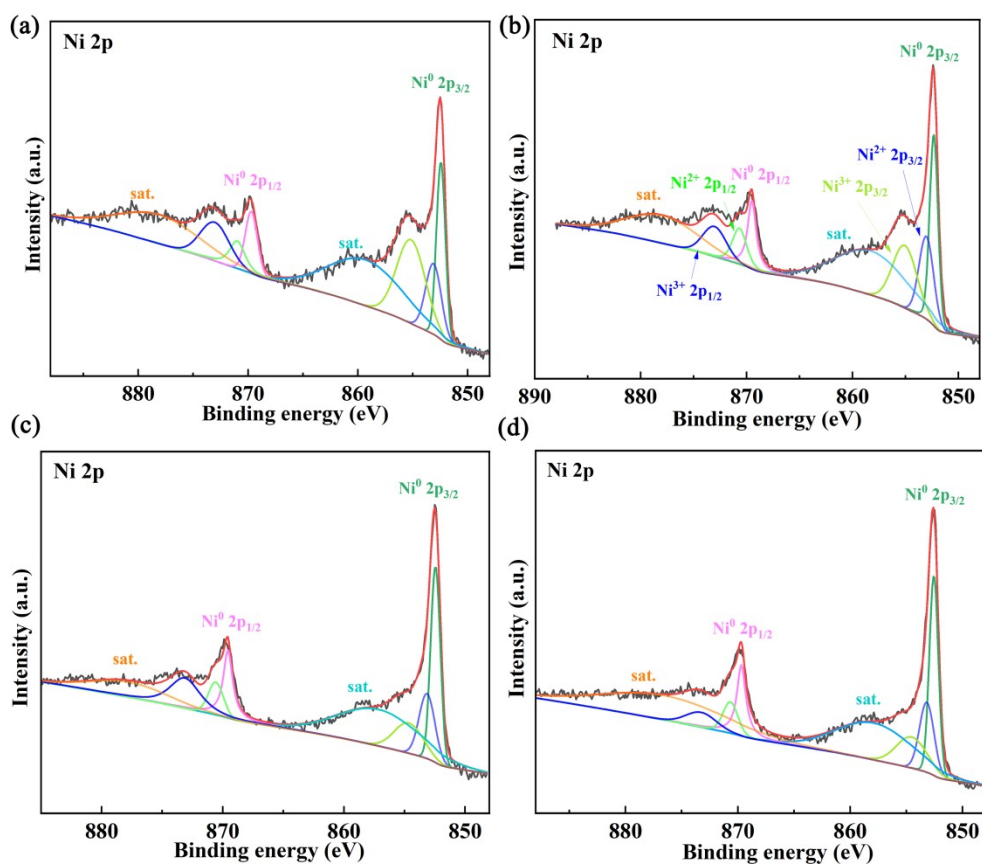


Fig. S4 The Ni 2p spectrum of Ni/NiO_x@NC-AA-T : (a) 480°C, (b) 540°C, (c) 600°C, (d) 660°C.

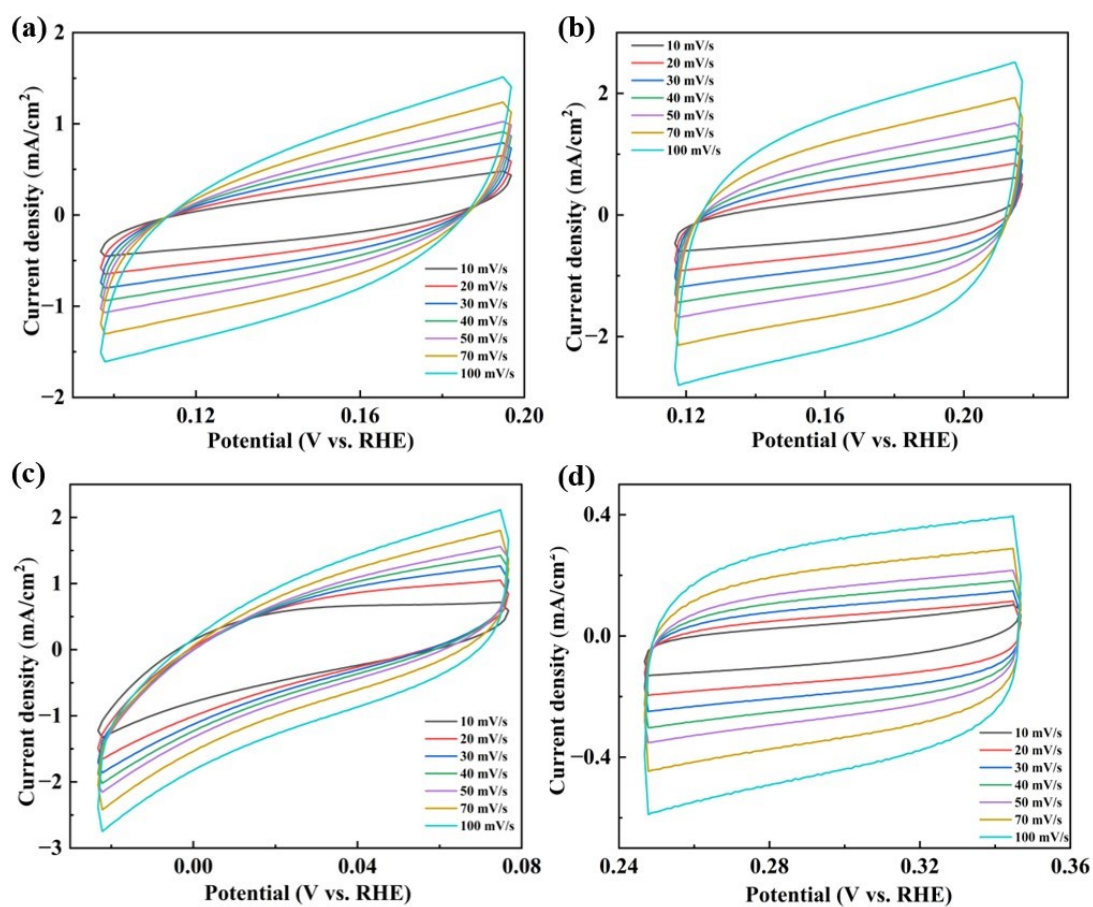


Fig. S5 Cyclic voltammetric curves of Ni/NiO@NC-480(a), -540(b), -600(c) and -660(d) at different scan rates where no faradaic reactions occurred. at different scan rates where no faradaic reactions occurred.

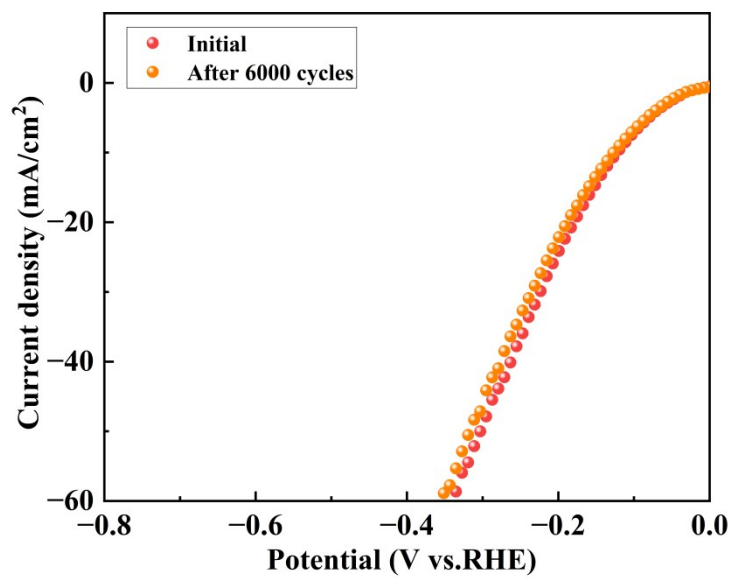


Fig. S6 Polarization curves before and after 6000 CV cycles (-0.9 V ~ -1.4 V)

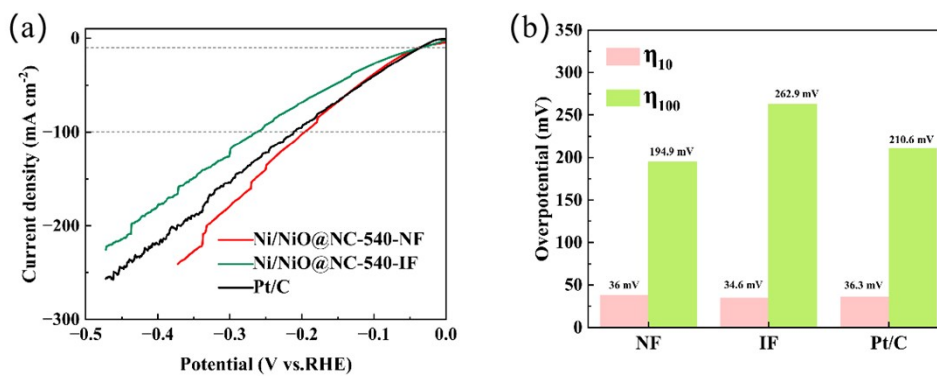


Fig. S7 (a) LSVs of Ni/NiO@NC-540-NF, -IF and 20w% Pt/C for HER. (b) Overpotentials of different catalysts at current densities of 10 mA cm⁻² and 100 mA cm⁻².

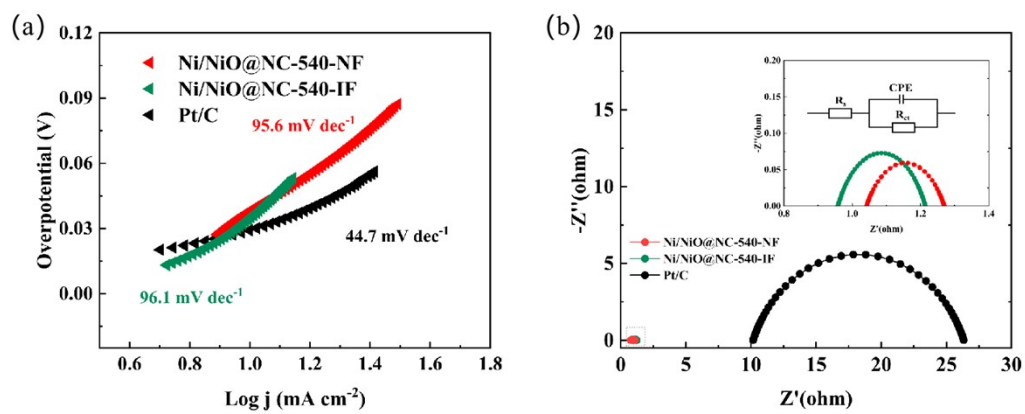


Fig. S8 (a) The Tafel slope of Ni/NiO@NC-540-NF, -IF and 20w% Pt/C for HER. (b) The relevant EIS plot.

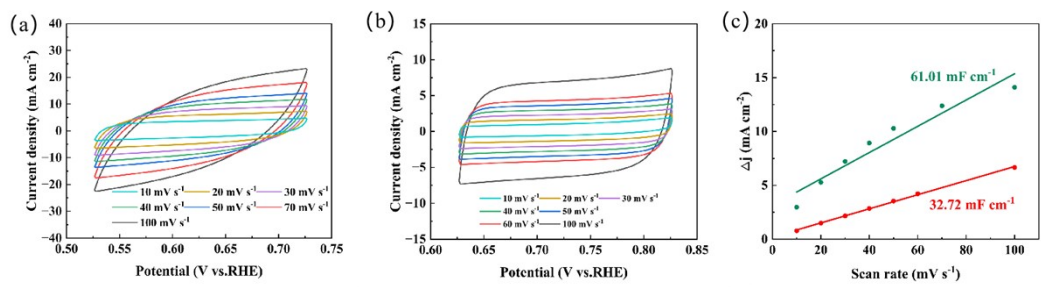


Fig. S9 Cyclic voltametric curves of Ni/NiO@NC-540-IF(a) and -NF(b) at different scan rates where no faradaic reactions occurred. at different scan rates where no faradaic reactions occurred, the relevant Cdl plot (c).

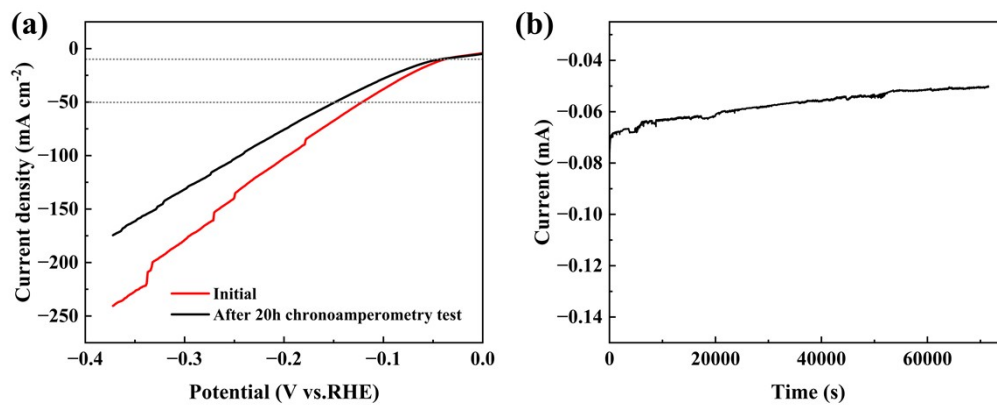


Fig. S10 Polarization curves before and after 20 h chronoamperometry test(a), (b)Chronoamperometry test of Ni/NiO/C-500-NF (50 mV vs. RHE).

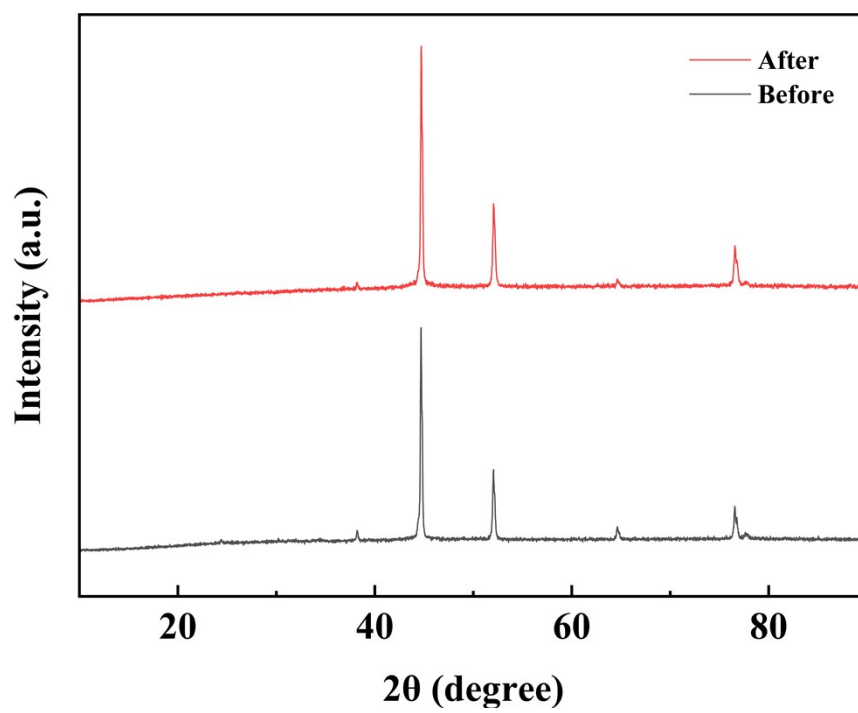


Fig. S11 XRD plots before and after 20 h chronoamperometry test

Table. S1 Content ratio of Ni with different valence states in Ni/NiO_x@NC-AA at different synthesis temperatures.

Catalysts	Ni ⁰ 2p _{3/2} (%)	Ni ²⁺ 2p _{3/2} (%)	Ni ³⁺ 2p _{3/2} (%)	Ni ⁰ /(Ni ²⁺ +Ni ³⁺)
Ni/NiO _x @NC-480	18.7	13.0	28.0	0.46
Ni/NiO _x @NC-540	21.4	15.6	19.4	0.61
Ni/NiO _x @NC-600	27.5	15.0	12.8	0.99
Ni/NiO _x @NC-660	27.6	15.4	14.3	0.93

Table.S2. Overpotential comparison of Ni/NiO@NC-540 and Ni/NiO@NC-540-NF with state-of-the-art Ni-based HER catalysts.

Catalyst	$\eta@10\text{mA cm}^{-2}$ [mV]	Reference
Ni/NiO-NC	179 (1 M KOH)	1
Sr-NiO	164 (4.24 M KOH)	2
NiO _x -AC-500	180 (0.1 M KOH)	3
Ni-NiO/Ti ₃ C ₂ T _x	72 (1 M KOH)	4
Ni-NiO@3DHPG	310 (1 M KOH)	5
H-Ni/NiO/C	87 (1 M KOH)	6
CNO@NSG	109.6 (1 M KOH)	7
CNN-500	127 (1 M KOH)	8
CoP/P-NiO/NF	52 (1 M KOH)	9
Mo-NiCoP/NF	64 (1M KOH)	10
P-Ni/Mo-TEC@NF	22 (1 M KOH)	11
Ni ₂ P/FeP-FF	42 (1M KOH)	12
CoS/Ni _x P _y /Fe-Ni ₃ S ₂ @NF	49 (1 M KOH)	13
NiWO ₄ -Ni ₃ S ₂ @NiO/NF-3	89 (1 M KOH)	14
Co ₂ P- <i>x</i> /Ni ₂ P- <i>y</i> @ NF	79 (1 M KOH)	15
Ni/NiO _x @NC-AA-540	100 (1 M KOH)	This work
Ni/NiO _x @NC-AA-540-NF	36 (1 M KOH)	This work

References

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