Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

High-valence chromium accelerated interface electron transfer for water oxidation

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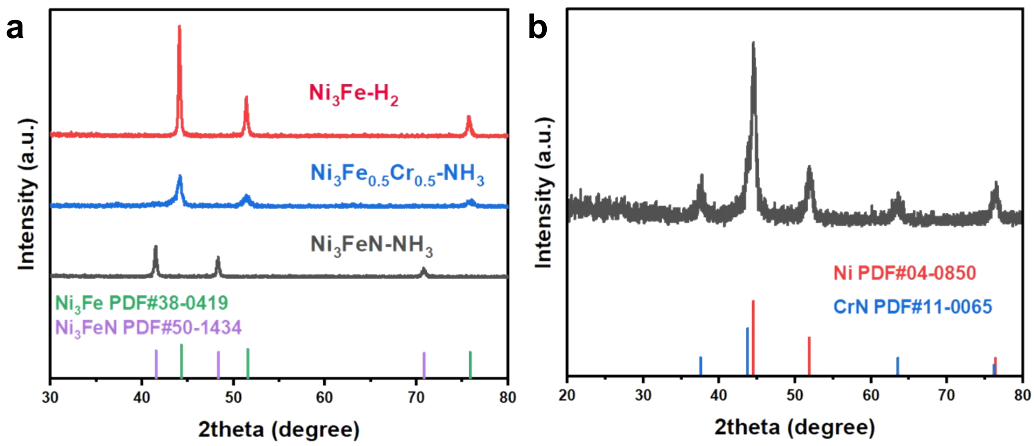

Fig S1. (a) XRD patterns of $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3, Ni_3Fe-H_2 and Ni_3FeN-NH_3. (b) XRD pattern of Ni_3Cr-NH_3.

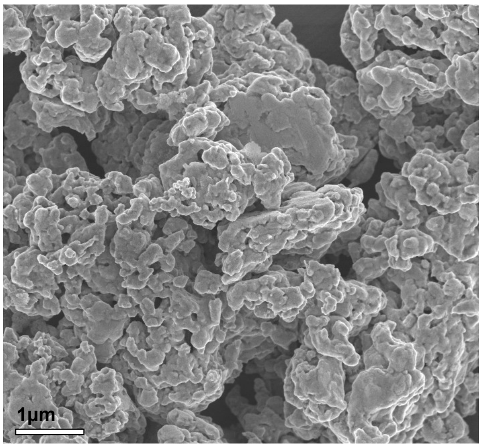

Fig S2. SEM image of Ni_3Fe.

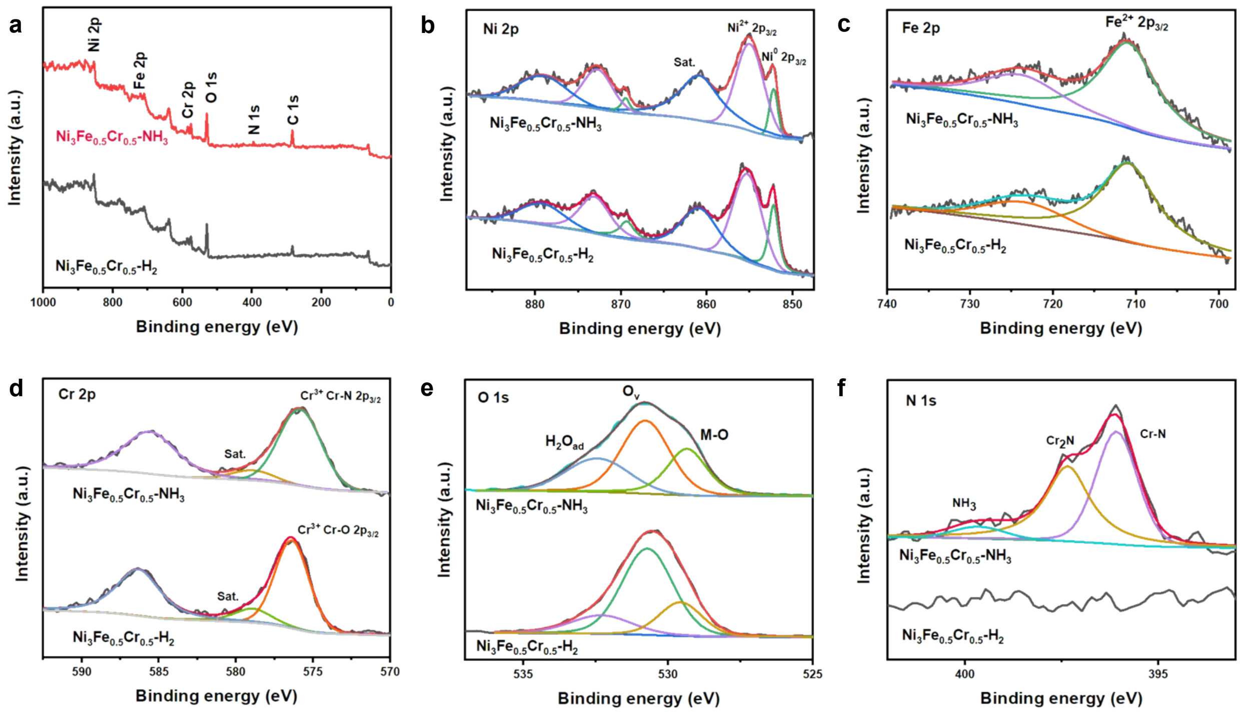

Fig S3. XPS spectra. (a) Survey spectra, (b) Ni 2p, (c) Fe 2p, (d) Cr 2p, (e) O 1s and (f) N 1s for $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3 and $Ni_3Fe_{0.5}Cr_{0.5}$-H_2.

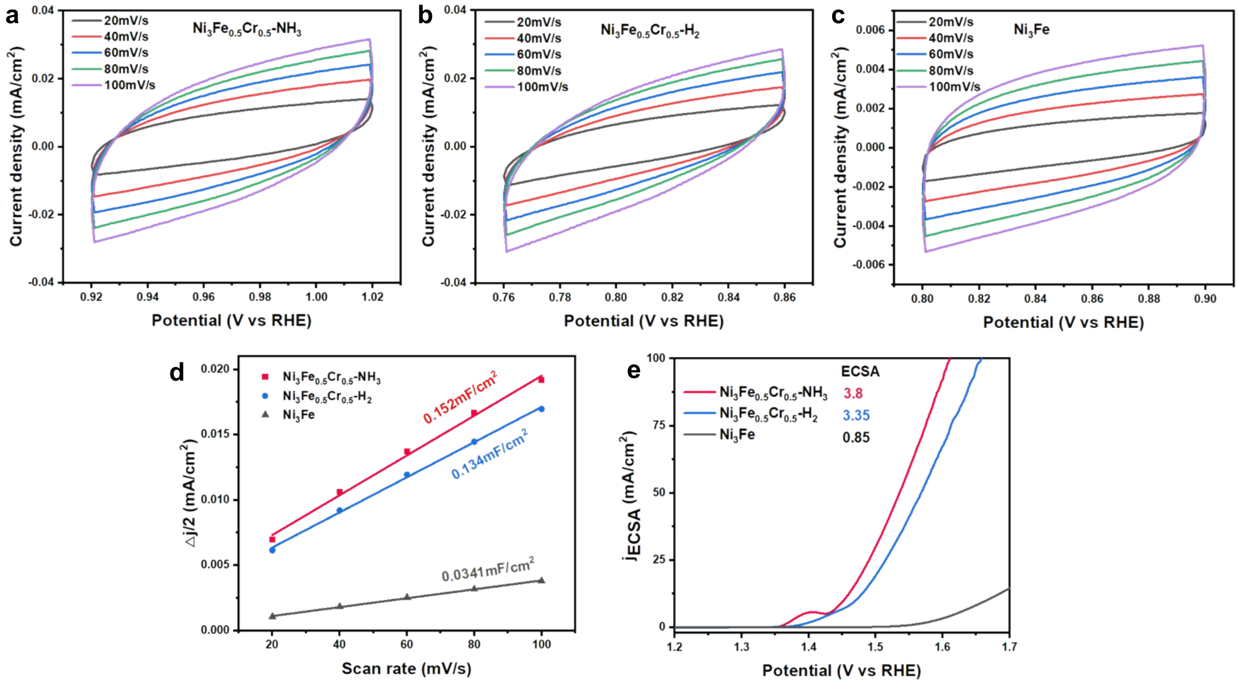

Fig S4. CV curves with different scan rates in non-faradic region. (a) $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3, (b) $Ni_3Fe_{0.5}Cr_{0.5}$-H_2, (c) Ni_3Fe at various scan rates (20, 40, 60, 80 and 100 mV/s) in 1.0 M KOH for OER. (d) Plots of capacitive current density versus scan rate. The slopes represent C_{dl}. (e) LSV curves normalized by ECSA of the as-prepared samples. The ECSA was calculated by double-layer capacitance.

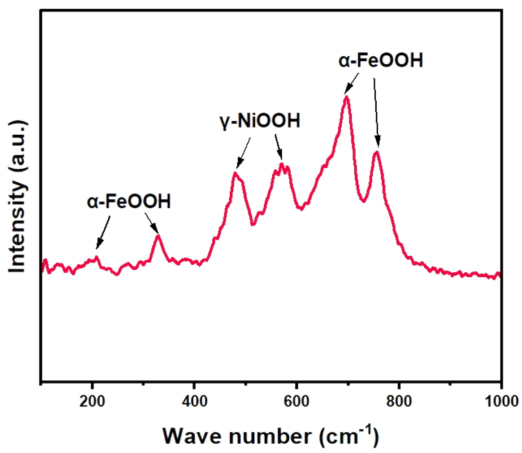

Fig S5. Raman spectrum of $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3 after OER**.**

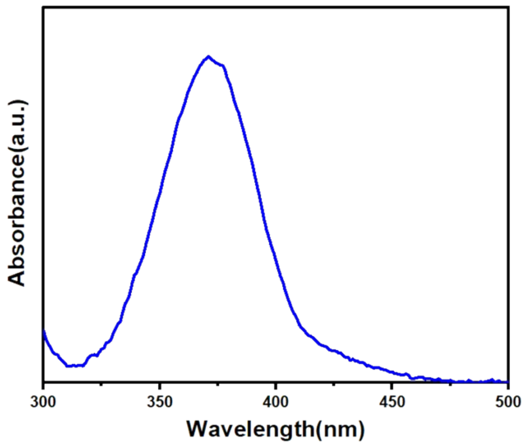

Fig S6. UV-vis spectroscopy of the electrolyte after the chronoamperometry measurement.

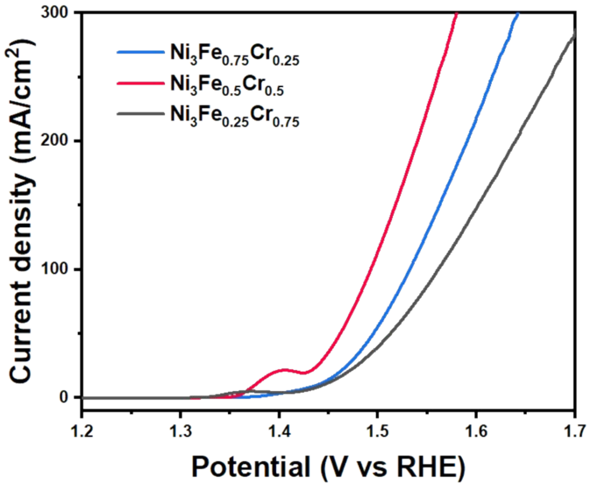

Fig S7.OER polarization curves of $Ni_3Fe_{1-x}Cr_x$–NH_3 (x=0.25, 0.5, 0.75) with 90 % iR correction at a scan rate of 10 mV/s in 1.0 M KOH.

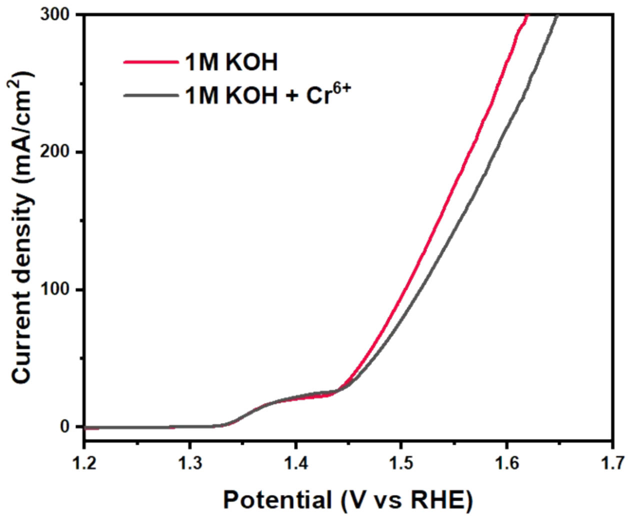

Fig S8. OER polarization curves of $Ni_3Fe_{0.5}Cr_{0.5}$–NH_3 with 90 % iR correction at a scan rate of 10 mV/s in 1.0 M KOH and 1.0 M KOH with Cr^{6+}.

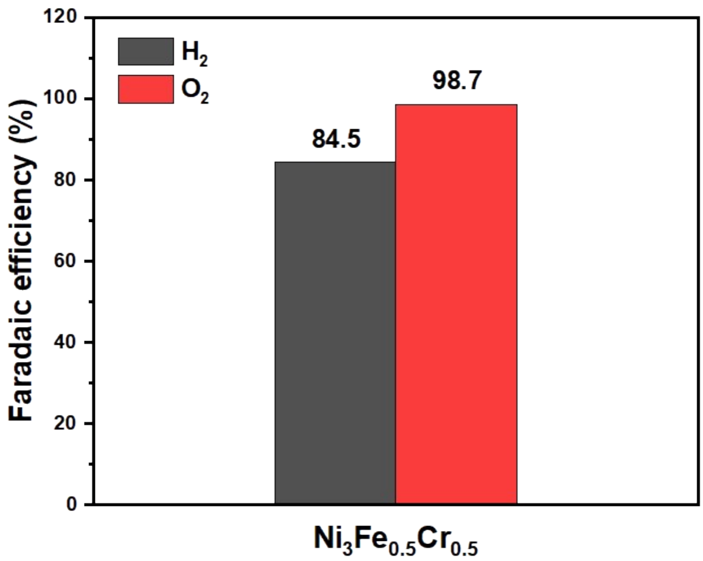

Fig S9. The faradaic efficiency of $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3.

Table S1. Compositions of the samples determined by ICP-AES.

Samples	The content of metal ions (mmol/L)			Mole ratio		
	Ni	Fe	Cr	Ni	Fe	Cr
$Ni_3Fe_{0.5}Cr_{0.5}$	1.20	0.21	0.18	3.08	0.54	0.46
After 10h OER	0.2835	0.0500	0.0047	3.06	0.54	0.051
After 20h OER	0.1894	0.0340	0.0033	2.99	0.54	0.05

Table S2. Concentrations of Cr Fe and Ni for $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3 after operating in different electrolytes, as shown in **Fig 5b,** determined by the atomic absorption spectrum.

	0-10h OER	**10-20h OER**
Concentration of Cr(μg/L)	237.66	ND
Concentration of Fe(μg/L)	ND	ND
Concentration of Ni(μg/L)	ND	ND

Table S3. Comparison of the OER performance of $Ni_3Fe_{0.5}Cr_{0.5}$-NH_3 to the recently reported Cr-NiFe catalysts.

Catalyst	Electrolyte	Substrates	Method	j (mA cm^{-2})	η (mV)	Reference
$Ni_3Fe_{0.5}Cr_{0.5}$-NH_3	**1.0 M KOH**	**Carbon paper**	**Dropping**	**25** **50**	**209** **232**	**This work**
NiFeCr-LDH	1.0 M KOH	Ni foam	Dropping	100	242	[1]
NiFeCr-LDH/MoS_2	1.0 M KOH	glassy carbon	Dropping	10	270	[2]
NiFeCr LDH	1.0 M KOH	Carbon paper	In situ growth	25	225	[3]
h-NiFeCr	1.0 M KOH	Ni foam	Electrodeposition	10	220	[4]
NiFeCr	1.0 M KOH	Ni foam	Electrodeposition	100	260	[5]
Cr_1/FeNi-LDH	1.0 M KOH	stainless steel	Electrodeposition	10	202	[6]
CS-NiFeCr	1.0 M KOH	Copper foil	Electrodeposition	10 50	200 230	[7]

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