Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supplementary Materials

An Amorphous $FeNiO_x$ Thin Film by Anodic Electrodeposition as Electrocatalyst toward Oxygen Evolution Reaction

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TOF calculation:

The TOF values were calculated by assuming that every metal atom is involved in the catalysis[1]:

$$\mathrm{TOF} = jS / 4Fn$$

where j (mA/cm^2) is the measured current density at $\eta = 470$ mV, S is the active surface area of catalyst deposited on ITO, the number 4 means 4 electrons/mol of O_2, F is Faraday's constant (96485.3 C/mol), and n is the moles of coated metal atom on the electrode calculated from mass loading and the molecular weight of the coated catalysts. The TOF of $FeNiO_x$ is calculated as 0.023 s^{-1}, which is much higher than NiO_x (0.001 s^{-1}) and FeO_x (0.0002 s^{-1}).

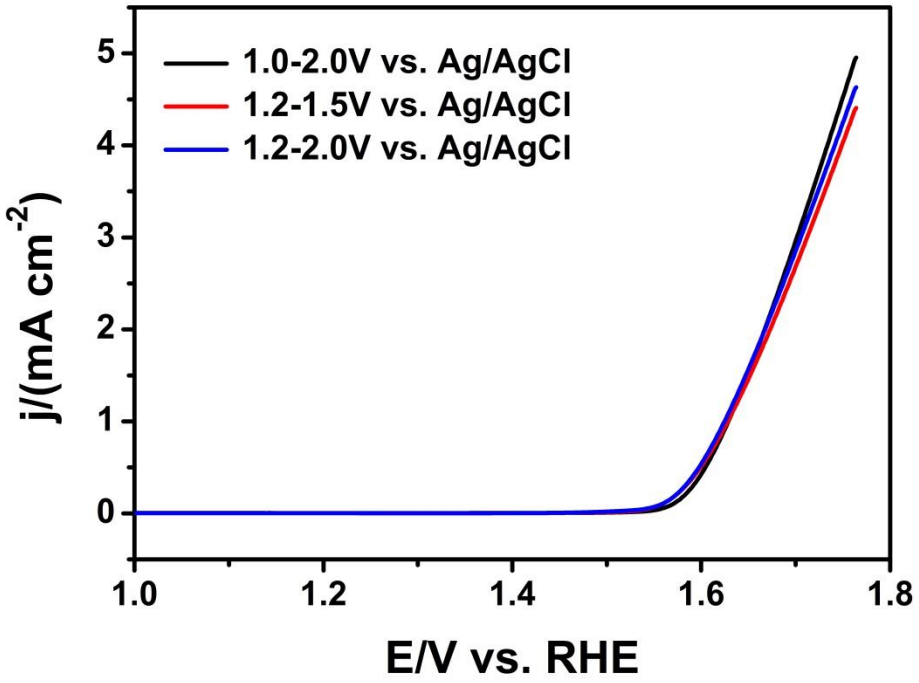


Fig. S1 LSV of $FeNiO_x$ catalysts via different electrodeposition CV potentials (in the range of 1.0 − 2.0 V, 1.2 − 1.5 V, 1.2 − 2.0 V (all vs. Ag/AgCl), respectively.) Deposition conditions: ITO substrate, 10 mM nickel(II) sulfate, 5 mM iron(III) sulfate, 0.1 M sodium acetate, pH ≈ 5.30, 20 mV s^{-1}, 75 CVs. All electrochemical measurements were performed in a 0.1 M KOH (pH ≈ 13.0, scan rate: 10 mV s^{-1}, room temperature).

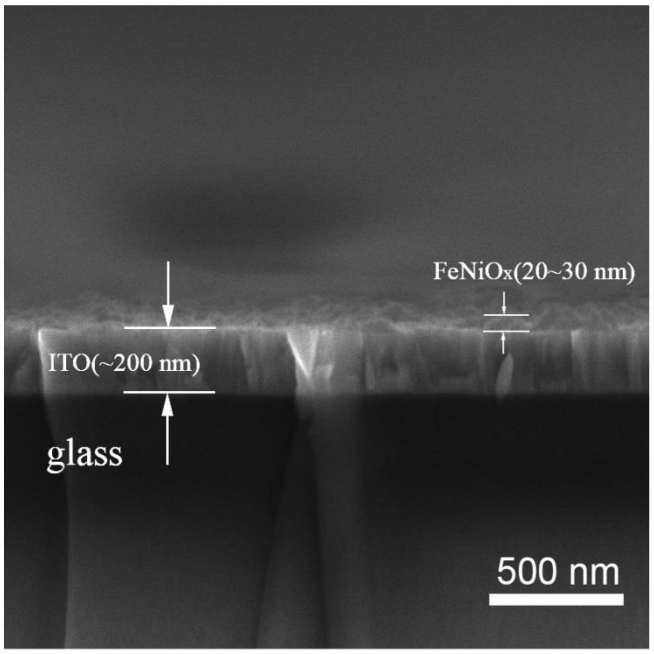


Fig. S2 The cross-section SEM image of the $FeNiO_x$/ITO catalyst. Scale bar corresponds to 500 nm.

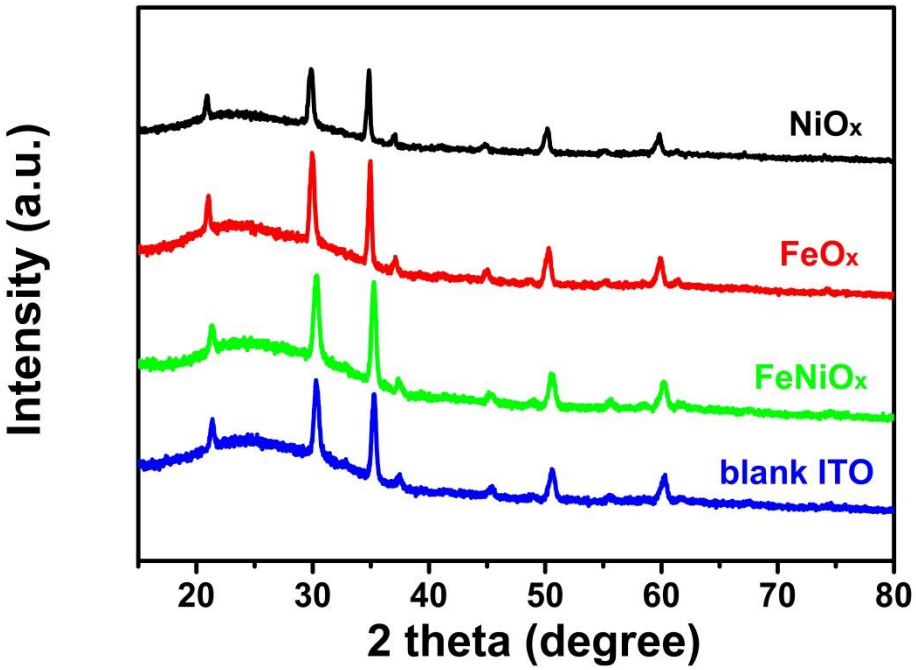


Fig. S3 XRD patterns of NiO_x/ITO, FeO_x/ITO, $FeNiO_x$/ITO thin films and blank ITO.

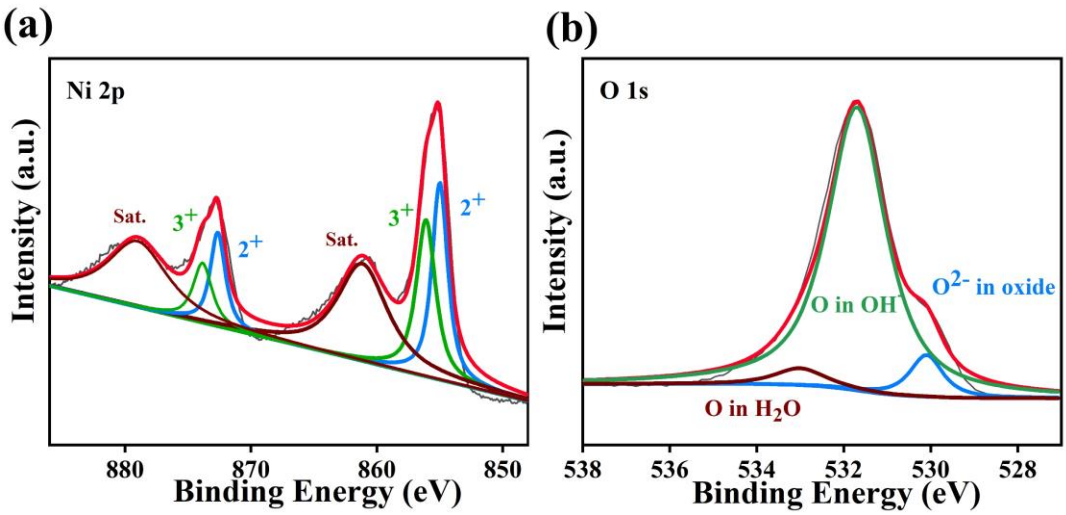


Fig. S4 XPS spectra of NiO_x catalyst: (a) Ni 2p and (b) O 1s spectra.

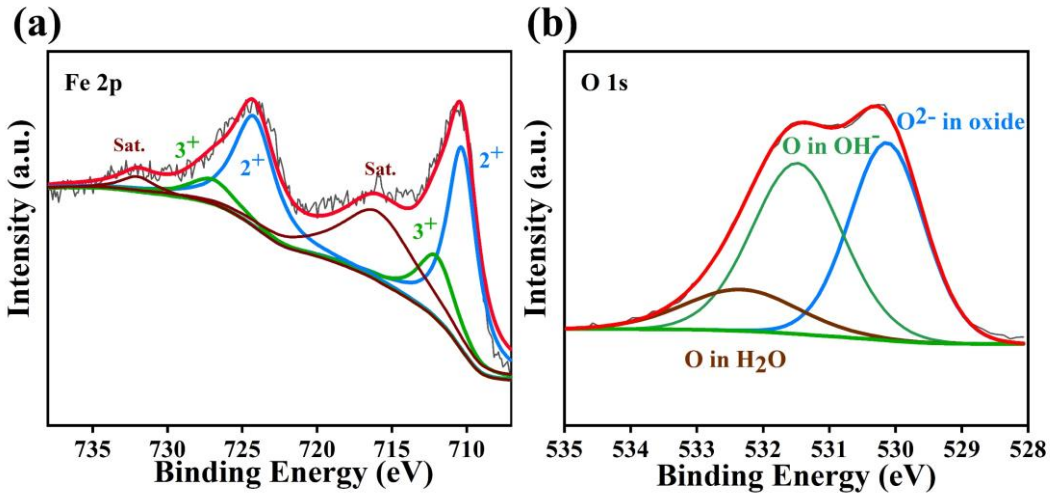
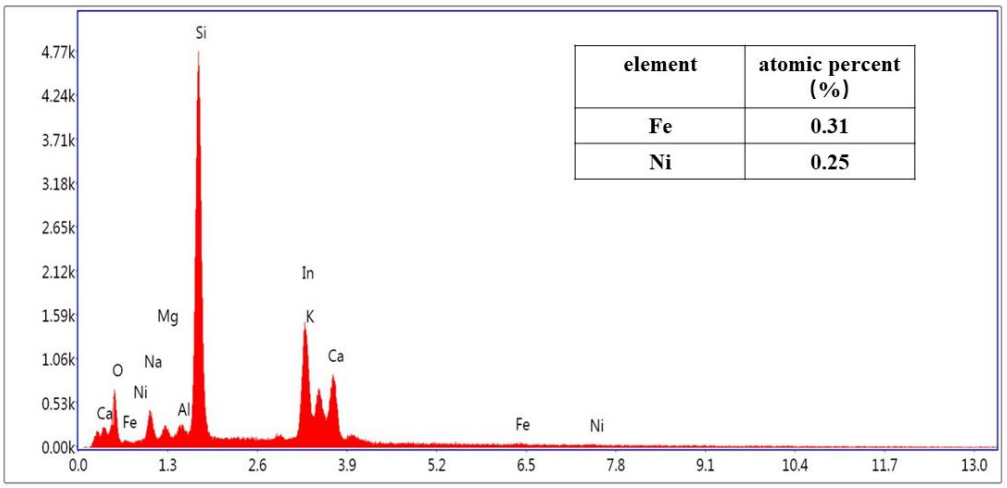


Fig. S5 XPS spectra of FeO_x catalyst: (a) Fe 2p and (b) O 1s spectra.



element	atomic percent (%)
Fe	0.31
Ni	0.25

Fig. S6 EDS of $FeNiO_x$ catalyst

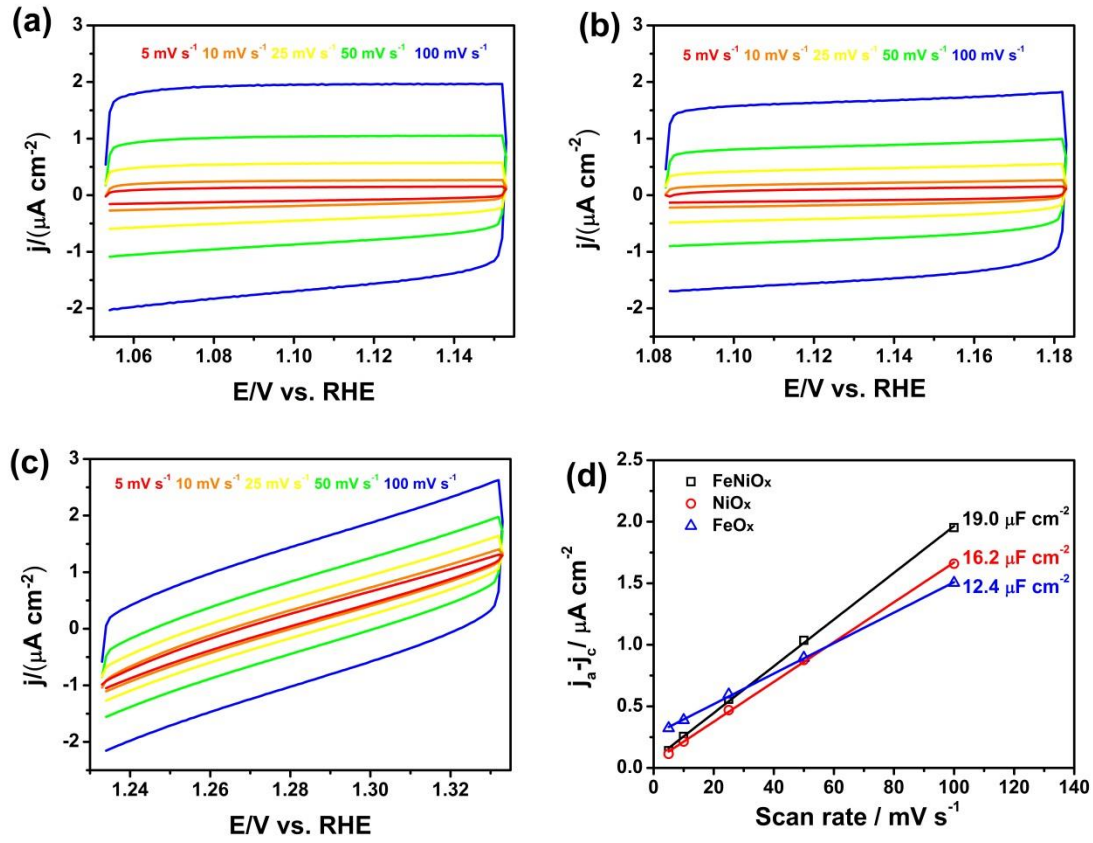


Fig. S7 (a) The CV of $FeNiO_x$ catalyst measured in a non-Faradaic potential window of 1.05 to 1.15 V vs. RHE. (b) The CV of NiO_x catalyst measured in a non-Faradaic potential window of 1.08 to 1.18 V vs. RHE. (c) The CV of FeO_x catalyst measured in a non-Faradaic potential window of 1.23 to 1.33 V vs. RHE. All the measurements were performed in 1 M KOH at the following scan rates: 5 (red), 10 (orange), 25 (yellow), 50 (green), 100 mV s^{-1} (blue). (d) Charging current density difference (j_a-j_c) plotted against scan rate. The linear slope is one times that of the C_{dl}. C_{dl} for $FeNiO_x$, NiO_x, and FeO_x are 19.0, 16.2, 12.4 μF cm^{-2}, respectively. ECSA for $FeNiO_x$, NiO_x, and FeO_x are 0.475, 0.405, 0.31 cm^2, respectively.

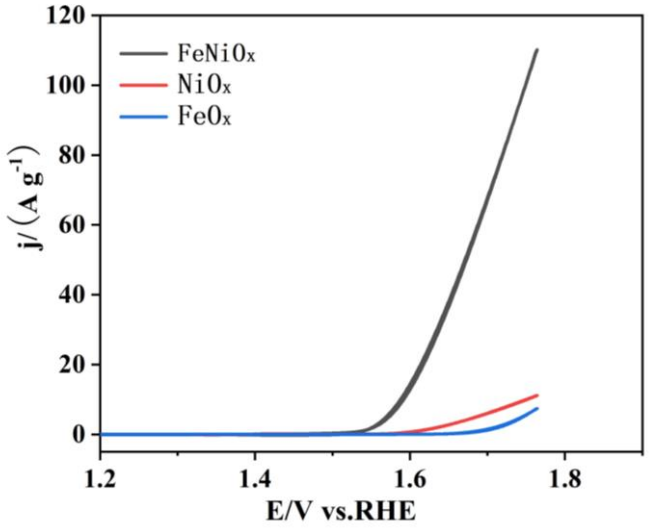


Fig. S8 The mass activity of $FeNiO_x$, NiO_x and FeO_x in 0.1 M KOH.

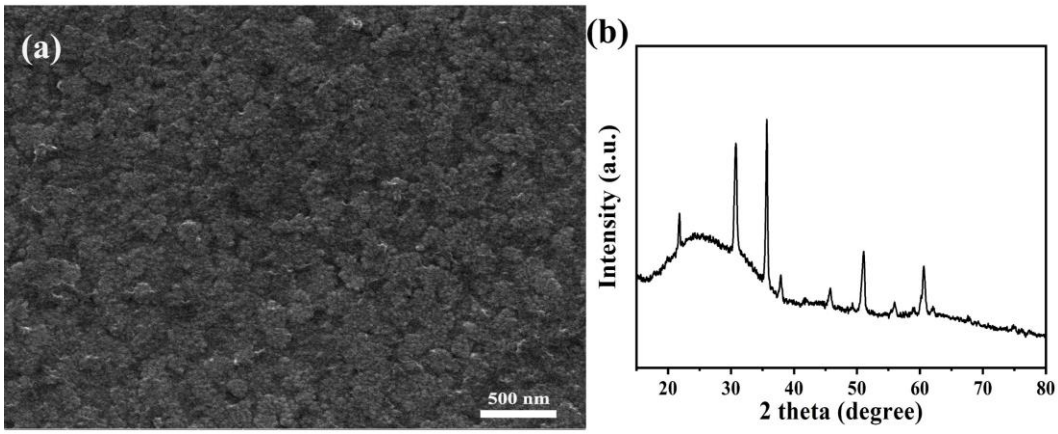


Fig. S9 SEM (a) and XRD pattern (b) of the $FeNiO_x$ after electrolysis.

Table S1 Concentrations of precursors in electrodeposition baths.

Catalysts	**$NiSO_4$**	**$Fe_2(SO_4)_3$**	**NaOAc**
$FeNiO_x$	10 mM	5 mM	0.1 M
NiO_x	10 mM		0.1 M
FeO_x		5 mM	0.1 M

References

1. Gao M R, Cao X, Gao Q, et al. ACS nano, 2014, 8(4): 3970-3978.