## Electronic Supplementary Information

# Nanostructured Fe-Ni Sulfide: A Multifunctional Material for Energy Conversion and Storage

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**Table S1:** Comparison of OER catalysis with other reports

| Catalyst | Overpotential (mV) at 10 mA/cm² | Tafel Slope (mV/decade) | Reference |
|---|---|---|---|
| $Fe_{0.1}Ni_{0.9}O$ | 297 | 37 | [1] |
| $Ni_{0.9}Fe_{0.1}$/NC | 270 | 45 | [2] |
| $FeNi_{4.34}$@FeNi | 283 | 53 | [3] |
| $CoFe_2O_4$ NF | ~420 | 82 | [4] |
| $NiCo_2O_4$ | 565 | 292 | [5] |
| $NiFe/CN_X$ | 360 | 59 | [6] |
| NiFe foam | 320 | - | [7] |
| $Ni_3S_2$ | 340 | 150 | [8] |
| NiSx | 408 | 56 | [9] |
| $Fe–Ni–O_X$/GC | 286 | 48 | [9] |
| $NiSe_2$ | 323 | 83.6 | [10] |
| Fe-$Ni_3S_2$/FeNi | 282 | 54 | [11] |
| **FeNiO** | **277** | **51** | **This work** |
| **FeNiS** | **246** | **49** | **This work** |

**Table S2:** Comparison of HER catalysis with other reports

| Catalyst | Overpotential (mV) at 10 mA/cm² | Tafel Slope (mV/decade) | Reference |
|---|---|---|---|
| $NiCo_2O_4$/CC | ~350 | 207 | [12] |
| NiS | 474 | 124 | [13] |
| $Ni_3S_2$ | 310 | 96 | [14] |
| EG/NiFe-LDH | ~380 | 125 | [15] |
| $Ni_{0.9}Fe_{0.1}$/NC | 231 | 111 | [2] |
| $NiS_2$ | 454 | 128 | [13] |
| $NiCo_2S_4$ | 240 | 81.3 | [14] |
| NiFe/NF | 269 | 69 | [16] |
| $Ni_3S_2$/NF | 318 | 74 | [16] |
| NiFeS/NF | 180 | 53 | [16] |
| **FeNiO** | **253** | **129** | **This work** |
| **FeNiS** | **208** | **109** | **This work** |

**Table S3:** Comparison for overall water splitting.

| Catalyst | Current density ($mA/cm^2$) | Voltage (V) | Reference |
|---|---|---|---|
| NiFe LDH/NF | 10 | 1.70 | [17] |
| NiFe/$NiCo_2O_4$/NF | 10 | 1.67 | [18] |
| $Fe_2Ni_2N$ | 10 | 1.65 | [19] |
| $Ni_3S_4$ nanosheets | 10 | 1.61 | [20] |
| NiSe/NF | 10 | 1.63 | [21] |
| NiFe-OH-$PO_4$/NF | 10 | 1.64 | [22] |
| $Ni_2P$ | 10 | 1.63 | [23] |
| NiS | 10 | 1.64 | [24] |
| $Ni_5P_4$ | 10 | 1.70 | [25] |
| $NiCo_2O_4$ | 10 | 1.65 | [26] |
| **FeNiS-Pt/C** | **10** | **1.535** | **This work** |

**Table S4:** Comparison of supercapacitor performance of some recently reported results.

| **Samples** | **Specific capacitance ($mF/cm^2$)** | **Current density ($mA/cm^2$)** | **Reference** |
|---|---|---|---|
| Ni–Co sulfide/NF | 2,940 | 30 | [27] |
| $Ni_3S_2$@Ni(OH)$_2$/3DGN | 3,850 | 19.1 | [28] |
| $NiCo_2O_4$@$MnO_2$ | ~2,000 | 10 | [29] |
| $Co_{0.67}Ni_{0.33}$DHs/$NiCo_2O_4$/CFP | 1,640 | 2 | [30] |
| NiS hollow spheres | 2640 | 4 | [31] |
| FeOOH | 1,110 | 5 | [32] |
| Co-Ni double hydroxides | 1,480 | 5 | [32] |
| Co3O4@NiMoO4 | 5,690 | 30 | [33] |
| $Co_3O_4$ | 1,100 | 30 | [33] |
| **FeNiS** | **4,921** | **5** | **This work** |

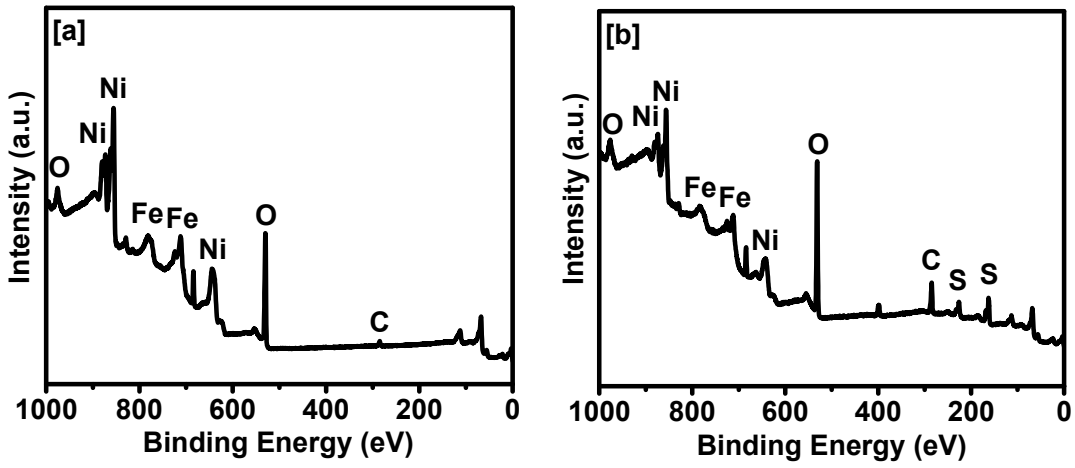


**Figure S1:** XPS survey spectra of (a) FeNiO and (b) sulfurized FeNiO.

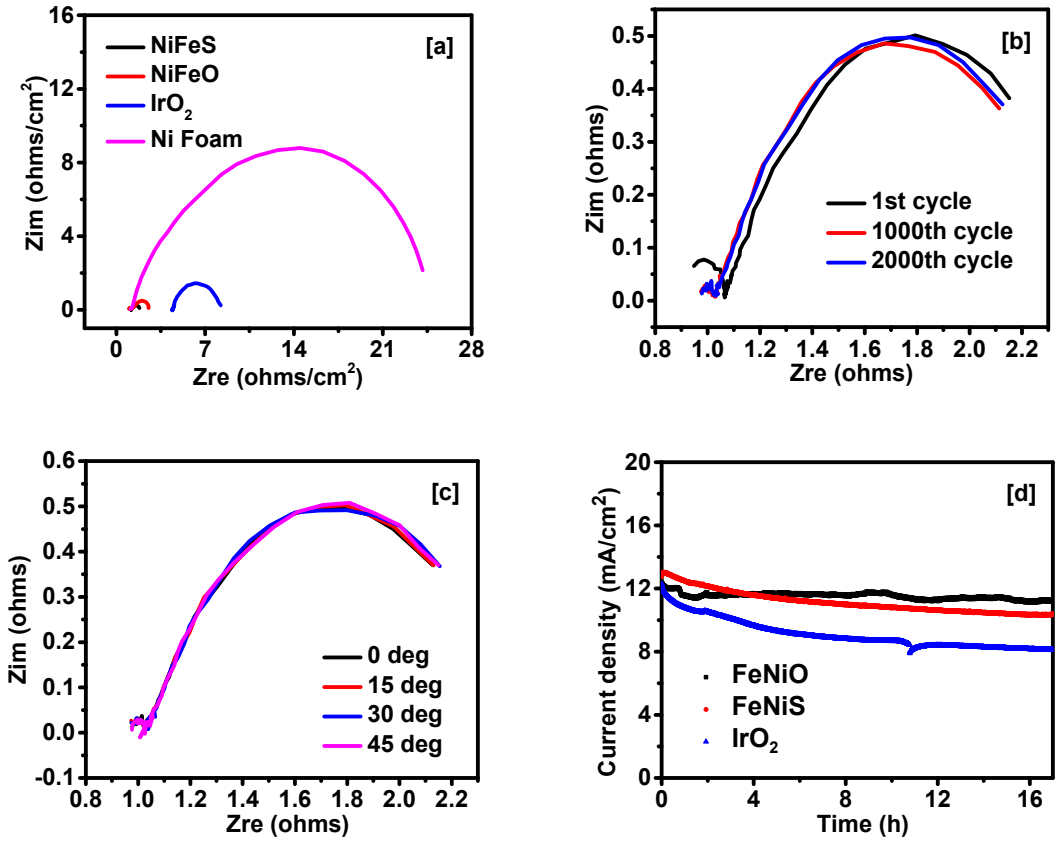


**Figure S2:** (a) Nyquist plot for all the OER catalytic electrodes at 0.5 V, (b) Nyquist plot at different stability cycles at 0.5 V, (c) Nyquist plot at different bending angles at 0.5 V, and (d) chronoamperometry.

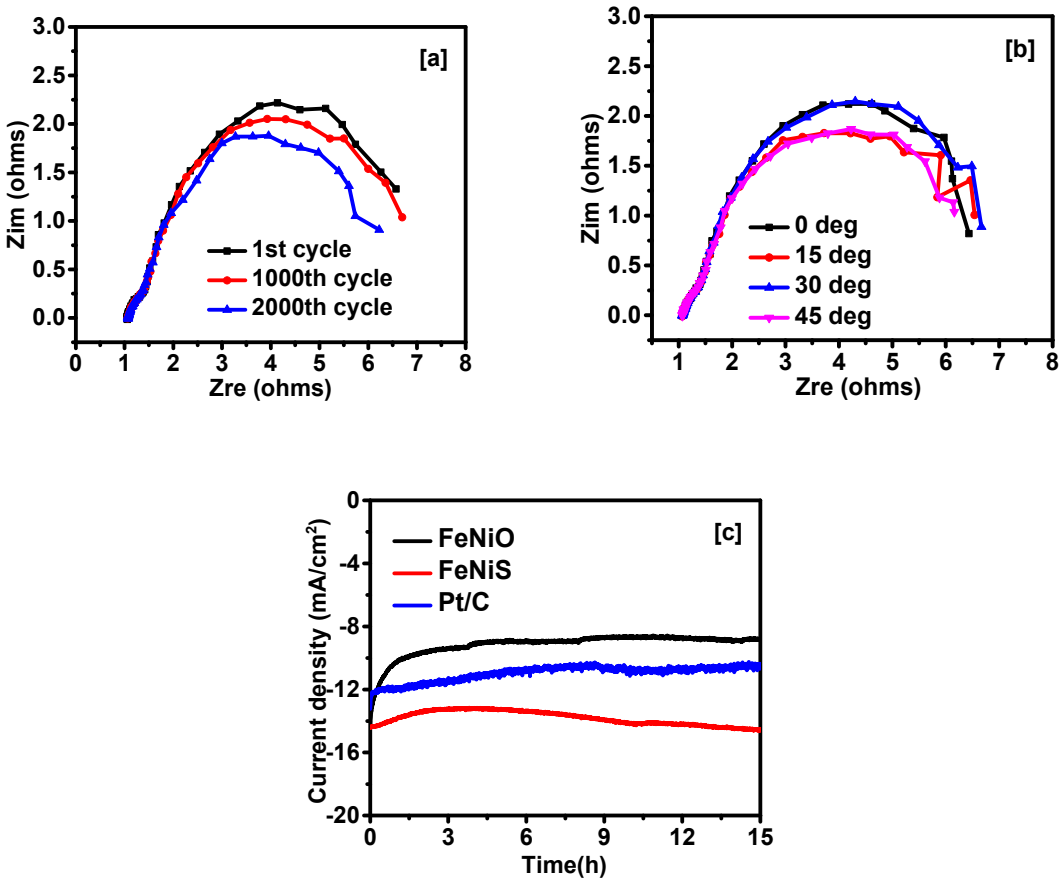


**Figure S3:** (a) Nyquist plot at different stability cycles at -1.3 V, (b) Nyquist plot at different bending angles at -1.3 V and, (c) chronoamperometry.

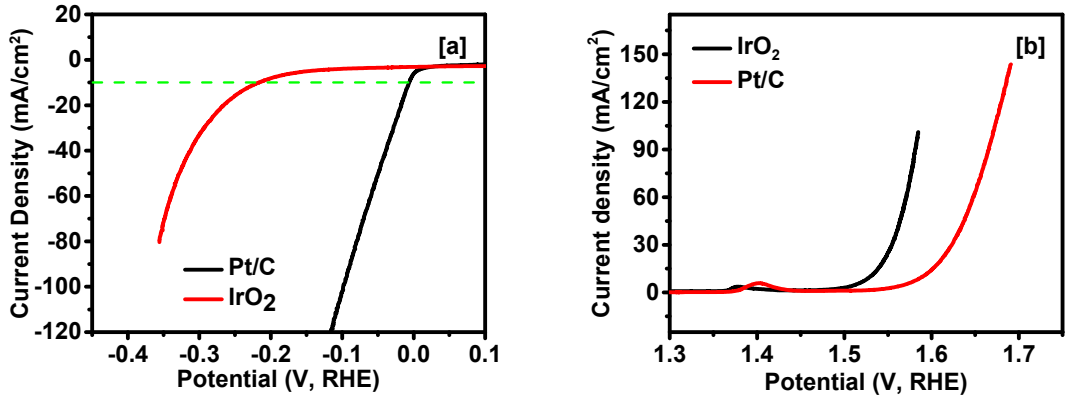


**Figure S4:** LSV polarization curves for Pt/C and $IrO_2$: (a) HER and (b) OER.

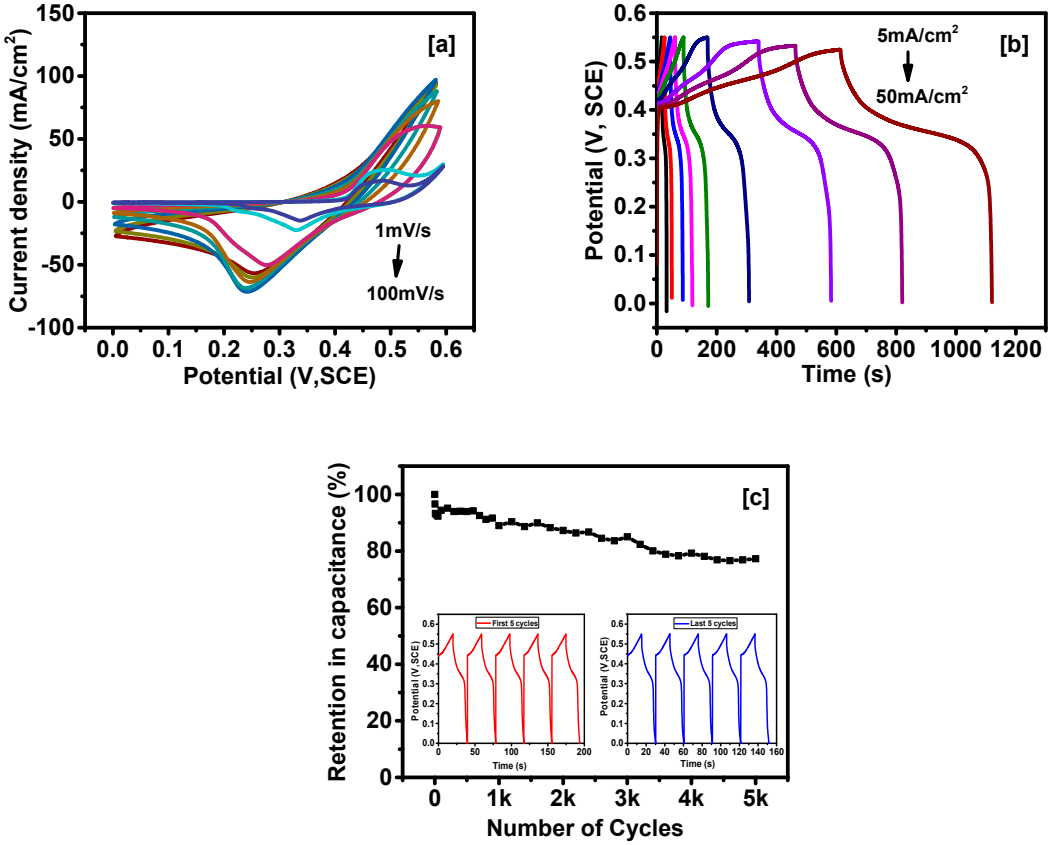


**Figure S5:** Characteristics of FeNiS: (a) CV curves, (b) GCD curves and (c) cyclic stability plot for FeNiS sample using GCD measurements.

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