Supporting Information

In situ autologous growth of self-supporting NiFe-based nanosheets on nickel foam as efficient electrocatalyst for oxygen evolution reaction

Jianying Wang,[1] Xue Teng,[1] Yanli Niu,[1] Lixia Guo,[1] Jianfei Kong,[2] Xiaoming He[1] and Zuofeng Chen*,[1]

1. Shanghai Key Lab of Chemical Assessment and Sustainability, School of Chemical Science and Engineering, Tongji University, Shanghai 200092, China; 2. Jiangsu Vocational College of Medicine, Yancheng 224005, Jiangsu Province, China.

EXPERIMENTAL

Tafel plot. The current-potential data of the nickel foam with an active catalyst coating were obtained by linear sweep voltammetry (LSV) at a very slow scan rate of 0.1 mV/s. The Tafel slope was obtained from the LSV plot using a linear fit applied to points in the Tafel region. The solution resistance measured prior to the data collection (using *iR* test function) was used to correct the Tafel plot for the *iR* drop.

Electrochemical impedance spectroscopy (EIS). The EIS was recorded under given overpotentials over a frequency range from 0.01 Hz to 1 MHz at the amplitude of the sinusoidal voltage of 5 mV. The explicit Nyquist plots were obtained based on the EIS data.

Calculation of ECSA. The electrochemically active surface area (ECSA) of the electrocatalysts is evaluated by measurement of their double layer charging capacitance in 1 M KOH solution. Briefly, a potential range where no apparent Faradaic process occurred was determined firstly using cyclic voltammetry (CV). The charging current (i_c) in this potential range was then measured from CV plots at different scan rates. The relationship between i_c, the scan rate (v), and the double layer charging capacitance (C_{DL}) was governed by eq 1.

$$i_c = vC_{DL} \quad (1)$$

From the slope of the plot of i_c *vs.* v, C_{DL} could be obtained which is directly proportional to ECSA. Based on the estimated specific capacitance (0.040 mF/cm^2) for a planar $NiFeO_x$ electrode in 1 M NaOH adopted from literature reports, ECSA of the studied electrode could be calculated by ECSA = C_{DL}/0.040.

Prior to each measurement, the platinum plate counter electrode was routinely treated by soaking in 1 M hydrochloric acid to remove any deposited species. Prior to the experiment, the electrolyte solution was saturated by bubbling O_2 for the OER measurement.

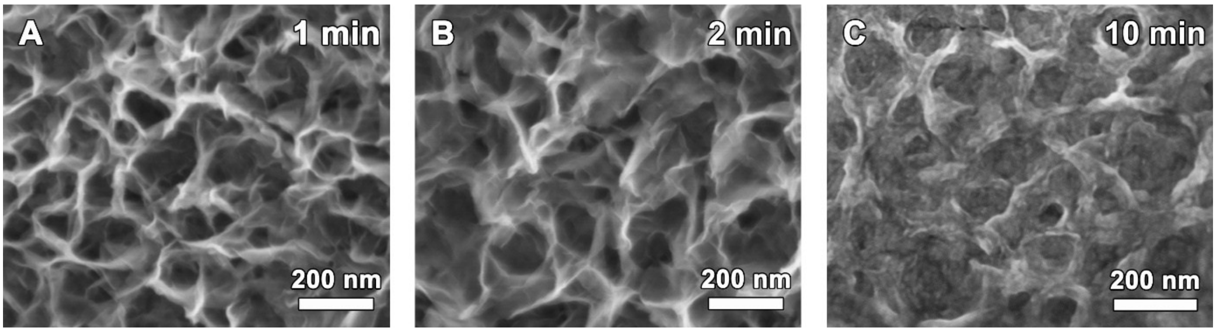

Figure S1. (A-C) SEM images of the $Ni(OH)_2$-Fe/NF electrodes prepared by different immersion time in Fe(III) solution (1 min, 2 min, 10 min).

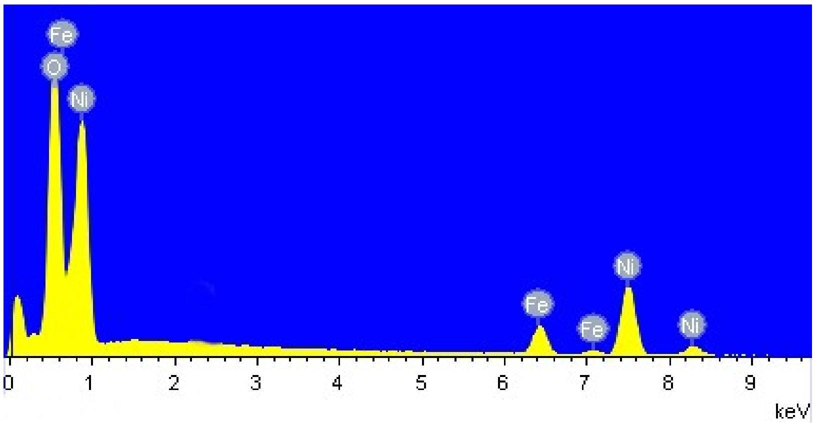

Figure S2. SEM-EDX of the $Ni(OH)_2$-Fe/NF electrode. The peak intensity ratio between Ni and Fe is 2.5:1.

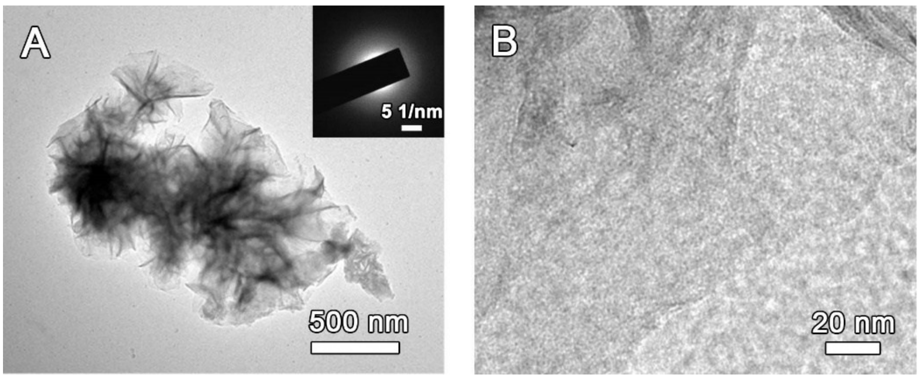

Figure S3. (A) TEM and (B) HRTEM images of $Ni(OH)_2$-Fe/NF electrode (inset is the SAED pattern).

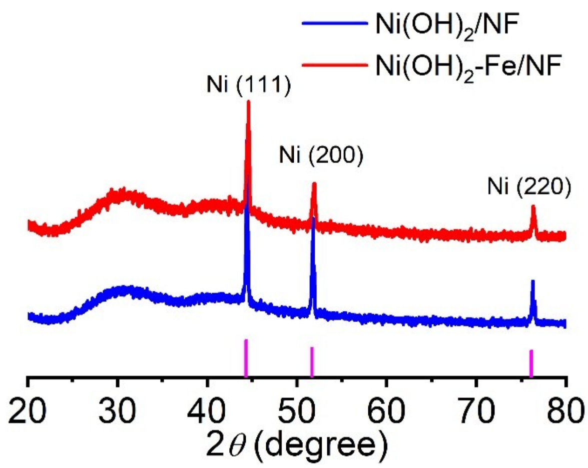

Figure S4. XRD patterns of the $Ni(OH)_2$/NF and $Ni(OH)_2$-Fe/NF electrodes.

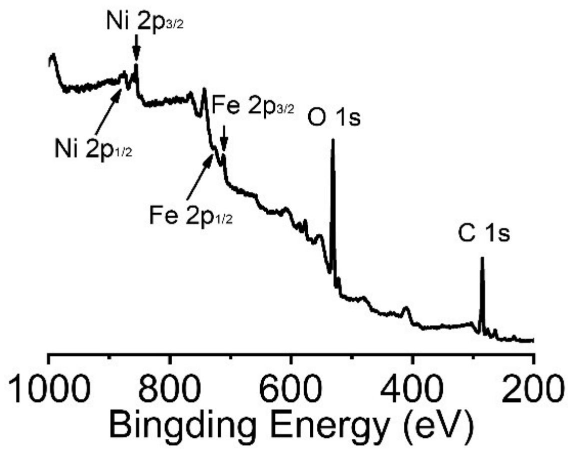

Figure S5. The survey XPS of the $Ni(OH)_2$-Fe/NF electrode.

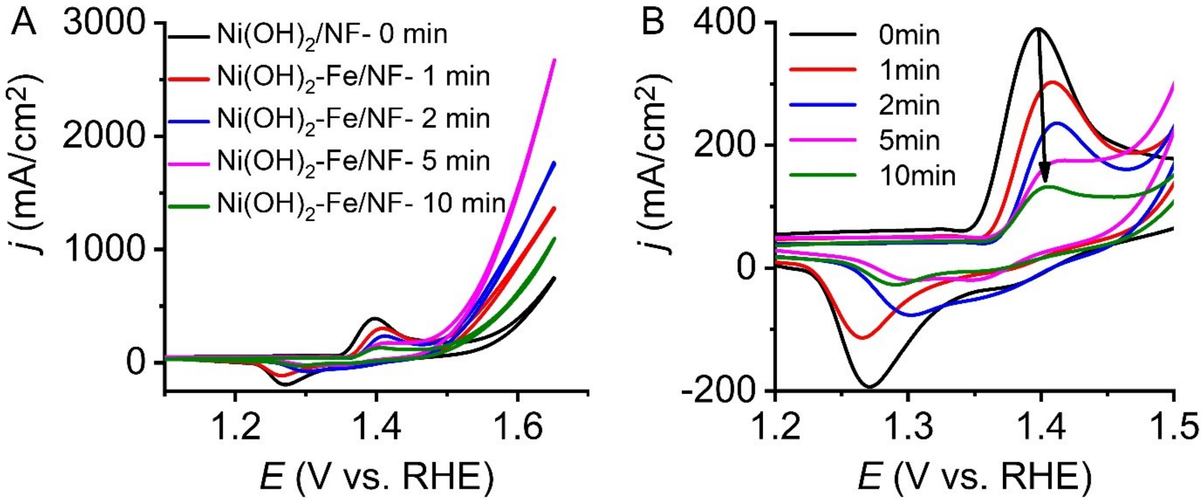

Figure S6. (A) CVs of the $Ni(OH)_2$-Fe/NF electrodes prepared by immersing the $Ni(OH)_2$/NF electrode in Fe(III) solution for different times in 1 M KOH solution. (B) Magnified view in the region of 1.2 - 1.5 V in (A). Scan rate: 20 mV/s.

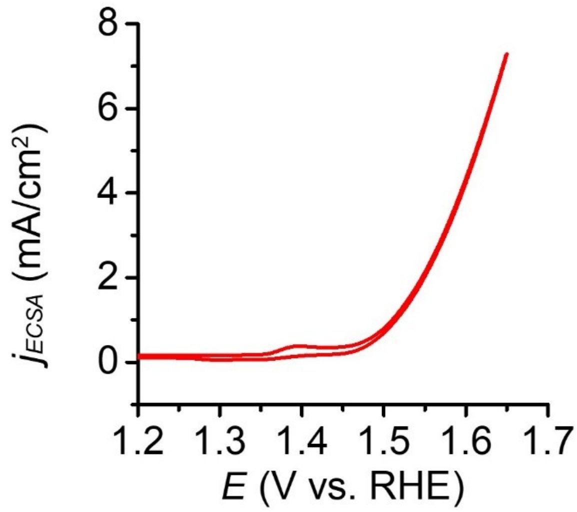

Figure S7. (A) Specific current density profile against the applied potentials based on the electrochemically active surface area (ECSA) of the electrode determined from double-layer capacitance. Scan rate: 20 mV/s.