Supporting Information

Boosting the oxygen evolution reaction activity of NiFe$_2$O$_4$ nanosheets by phosphate ion functionalization

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Figure S1. (a) Low- and (b) high-magnification SEM images of NiFe$_2$O$_4$ nanosheets.

Figure S2. (a) HRTEM image, (b) SAED pattern images and (c) EDS pattern of NiFe$_2$O$_4$ nanosheets.

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**Figure S3.** Nitrogen adsorption isotherms of NiFe$_2$O$_4$ and P-NiFe$_2$O$_4$ at 77 K.

**Figure S4.** EDS pattern of P-NiFe$_2$O$_4$ nanosheets.

**Figure S5.** XPS spectra of NiFe$_2$O$_4$ and P-NiFe$_2$O$_4$: (a) Survey, (b) Ni 2p.

**Figure S6.** Cyclic voltammograms curves in the double layer region at scan rate of 2, 4, 6, 8, 10, 12, 14, 16 mV/s
(along the arrow direction) of (a) NiFe$_2$O$_4$ and (b) P-NiFe$_2$O$_4$. 
Table S1. Comparison of the OER activity of P-NiFe$_2$O$_4$ nanosheets to several recently reported state of the art OER catalysts.

| Catalyst          | Morphology       | Overpotential $E_{j=10}$ (V vs. RHE) | Tafel (mV/dec) | Mass loading (mg/cm$^2$) | TOFs$_{300}$ (10$^{-2}$) | Substrate      | Electrolyte | Reference |
|-------------------|------------------|--------------------------------------|----------------|--------------------------|---------------------------|-----------------|-------------|-----------|
| P-NiFe$_2$O$_4$   | nanosheets       | 231                                  | 49             | 0.89                     | 2.5                       | carbon cloth    | 1.0 M KOH   | This work |
| FeNi/NiFe$_2$O$_4$@NC | microboxes      | 316                                  | 60             | 0.13                     | <0.1                      | glassy carbon   | 1.0 M KOH   | S1        |
| NiFe$_2$O$_3$NPs  | nanoparticles    | 286                                  | 38             | 0.28                     | N.A.                      | glassy carbon   | 1.0 M KOH   | S2        |
| FeCoNiO$_x$       | Amorphous        | 193                                  | 37             | N.A.                     | N.A.                      | glassy carbon   | 0.1 M KOH   | S3        |
| NiO/NiFe$_2$O$_4$ | nanorods         | 302                                  | 42             | N.A.                     | N.A.                      | glassy carbon   | 1.0 M KOH   | S4        |
| NiFe$_2$O$_4$     | microparticles   | 381                                  | 46.4           | N.A.                     | 0.057                     | glassy carbon   | 1.0 M KOH   | S5        |
| Ni$_2$FeN-NPs     | nanoparticles    | 241                                  | 59             | N.A.                     | N.A.                      | carbon cloth    | 1.0 M KOH   | S6        |
| CoFe$_2$O$_4$/PANI-MW | nanoparticles     | 310                                 | 30.69          | 0.285                    | 1.92                      | glassy carbon electrode | 1.0 M KOH   | S7        |
| CoFe$_2$O$_4$ NPs | nanoparticles    | 380                                  | 73             | 1.031                    | 0.06                      | carbon cloth    | 0.1 M KOH   | S8        |
| CoFe$_2$O$_4$/C   | nanorods         | 240                                  | 45             | 1.03                     | 0.53                      | Nickel foam     | 1.0 M KOH   | S9        |

a) $E_{j=10}$ for overpotential required for the current density of 10 mA/cm$^2$; b) TOFs$_{300}$ for the turnover frequencies at overpotential= 300 mV.
Figure S7. Chronopotentiometry of P-NiFe$_2$O$_4$ at different current density in 1.0 M KOH.

Figure S8. Polarization curves of P-NiFe$_2$O$_4$ after 50 h at 100 mA/cm$^2$.

Figure S9. LSV curves of P-NiFe$_2$O$_4$ after 50 h at various current density.
Reference

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