

**Manipulating all-pH hydrogen evolution kinetics on metal sulfides through one-pot simultaneously derived multi-interface engineering and phosphorus doping**

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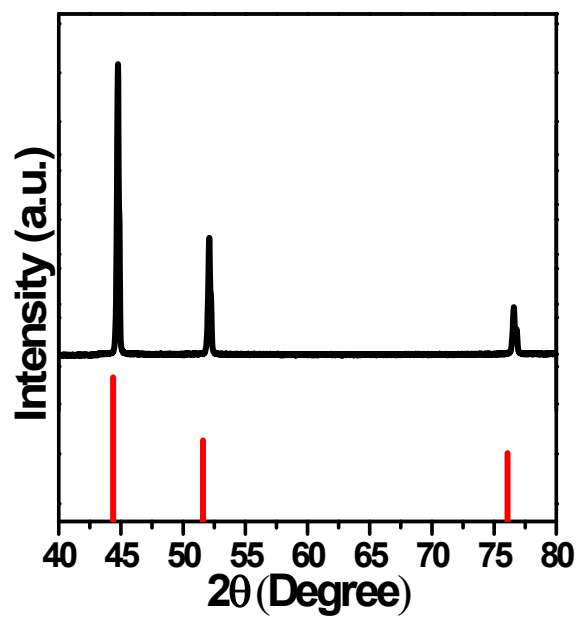


Figure S1 XRD of pristine nickel foam.

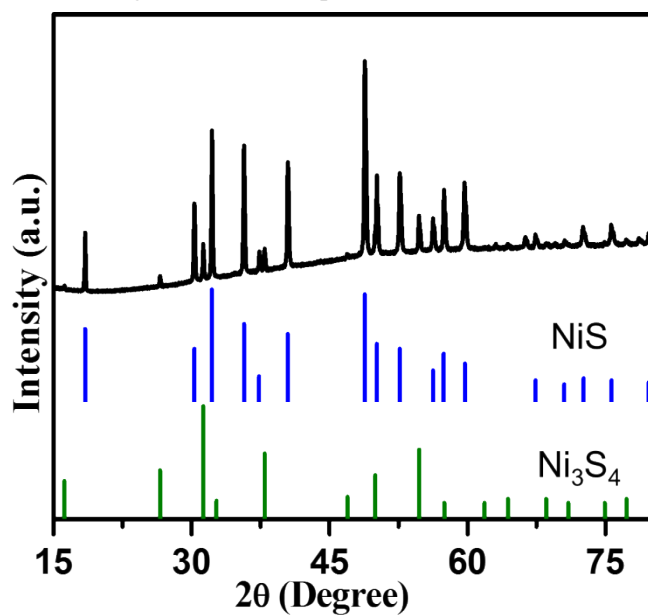


Figure S2 XRD of reference sample NiS/Ni<sub>3</sub>S<sub>4</sub>.

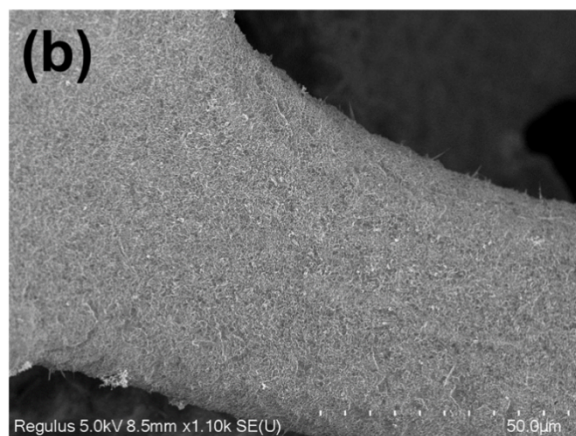
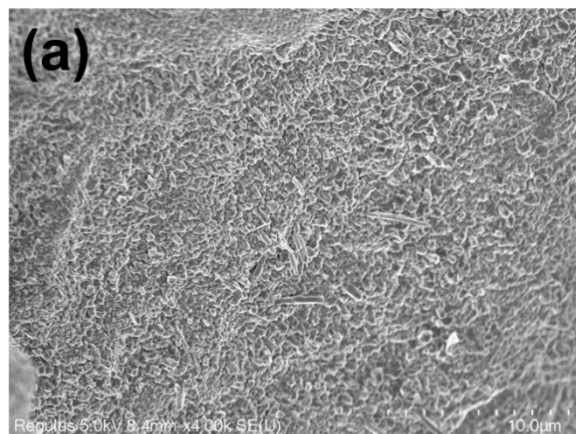


Figure S3 SEM images of reference sample NiS/Ni<sub>3</sub>S<sub>4</sub>.

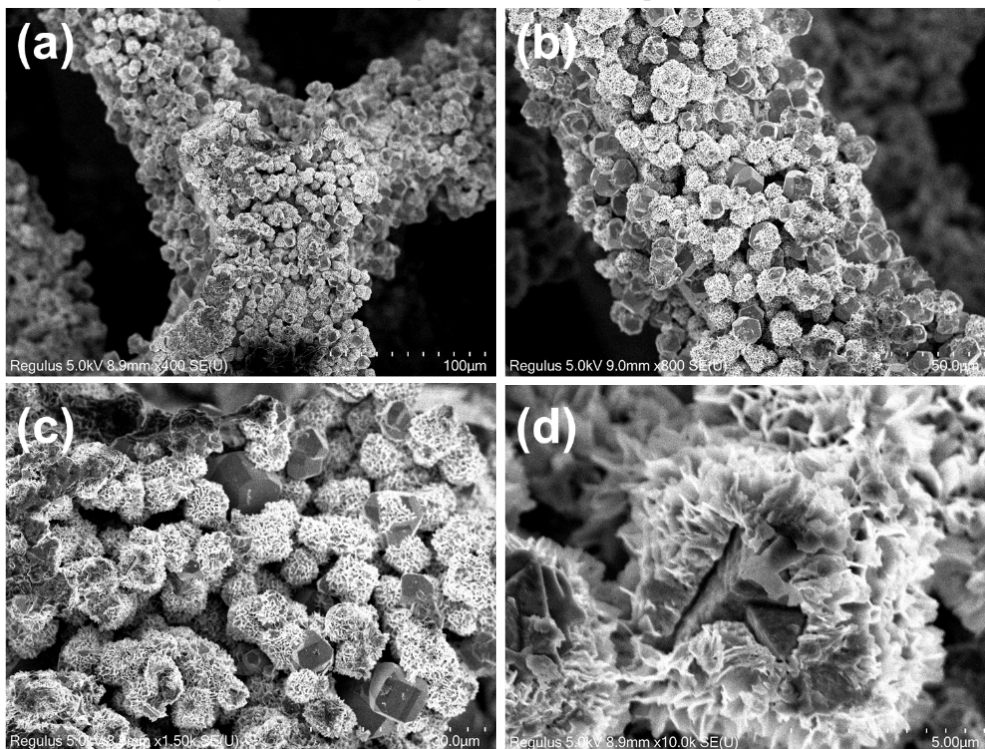


Figure S4 SEM images of NiS/WS<sub>2</sub>/Ni<sub>3</sub>S<sub>4</sub> prepared with 1g PW<sub>12</sub>.

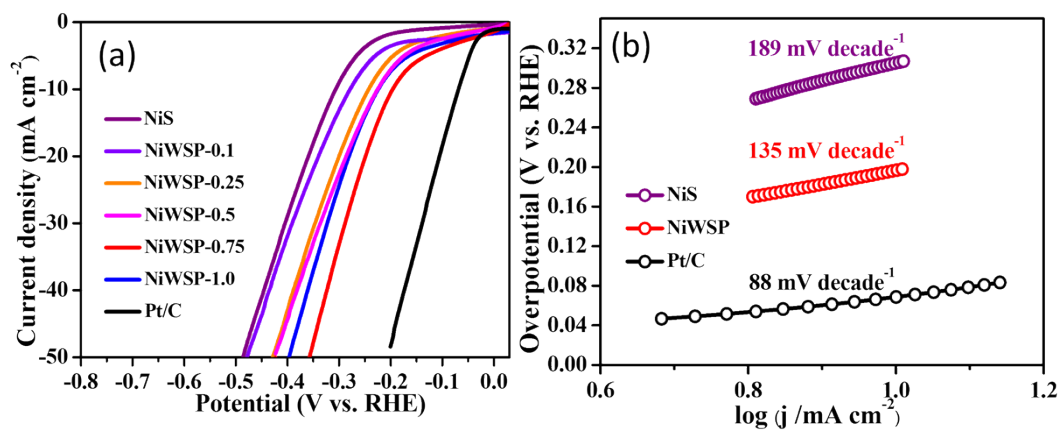


Figure S5 Linear sweep voltammetry (LSV) curve and Tafel plot in neutral condition.

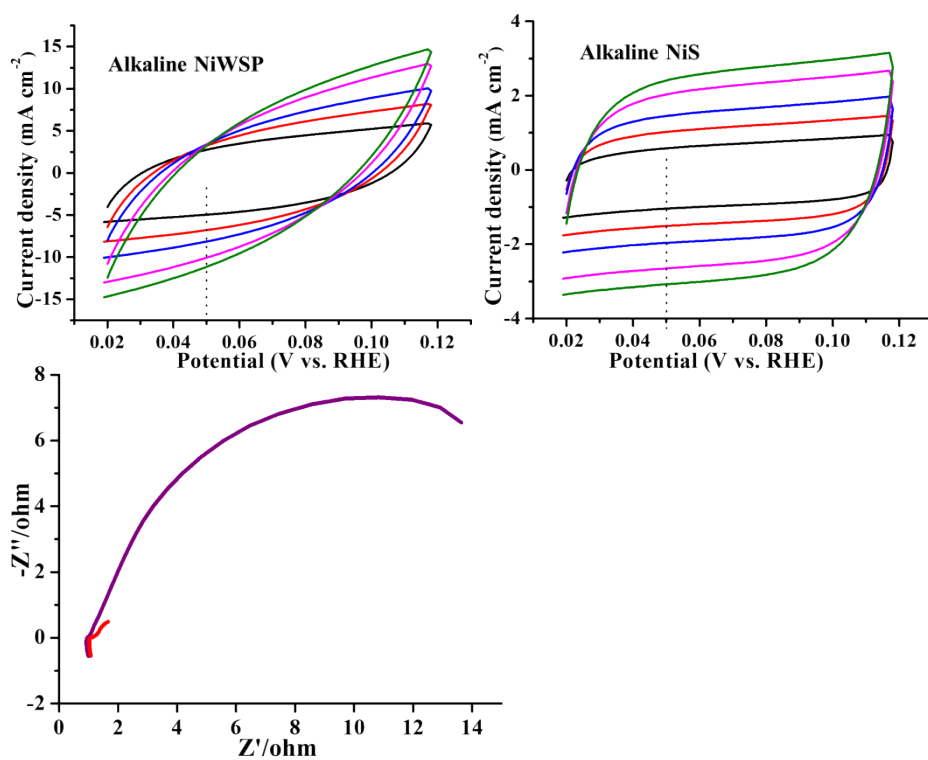


Figure S6 Non-Faradaic scan for double-layer capacitance in alkaline HER, and EIS Nyquist plots.

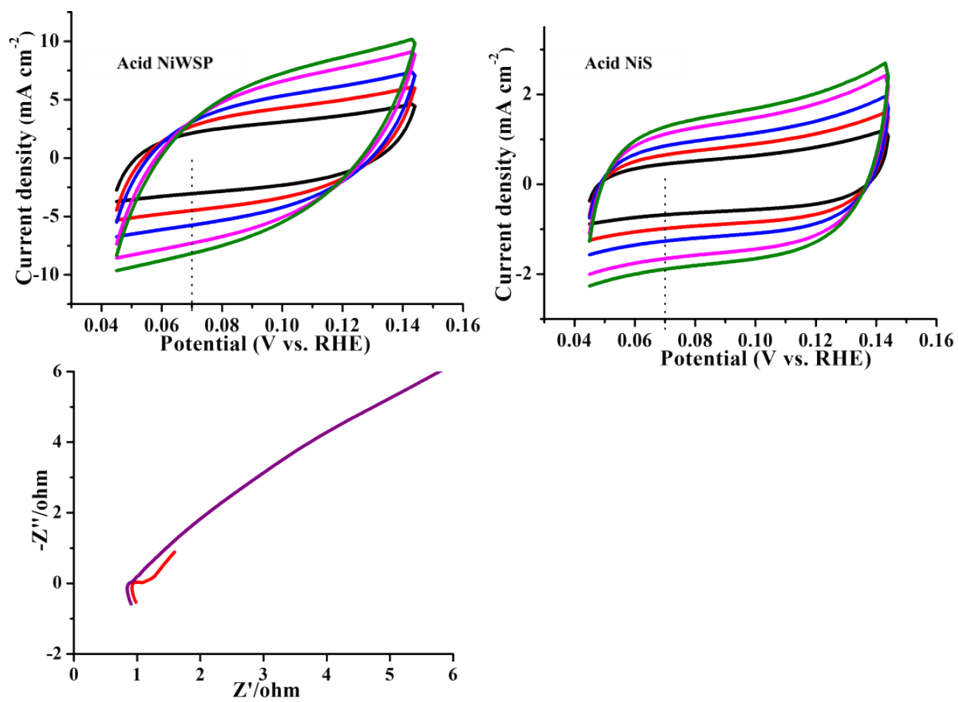


Figure S7 Non-Faradaic scan for double-layer capacitance in alkaline HER, and EIS Nyquist plots.

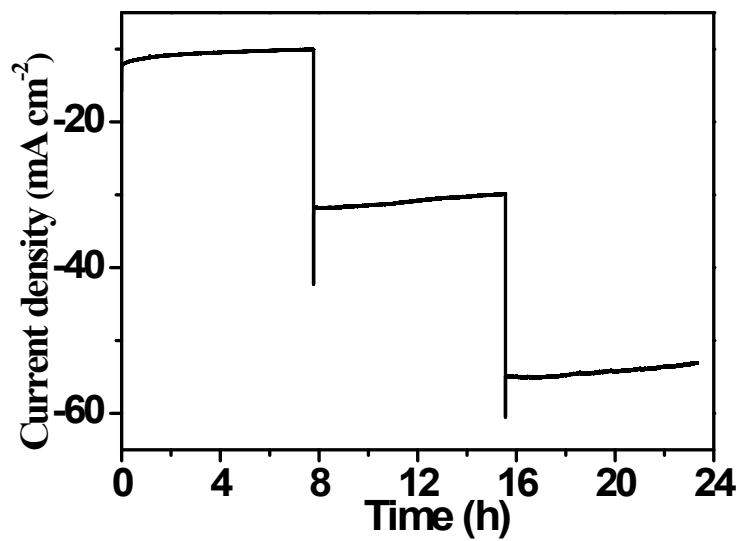


Figure S8 Time-dependent current density curve in neutral condition.

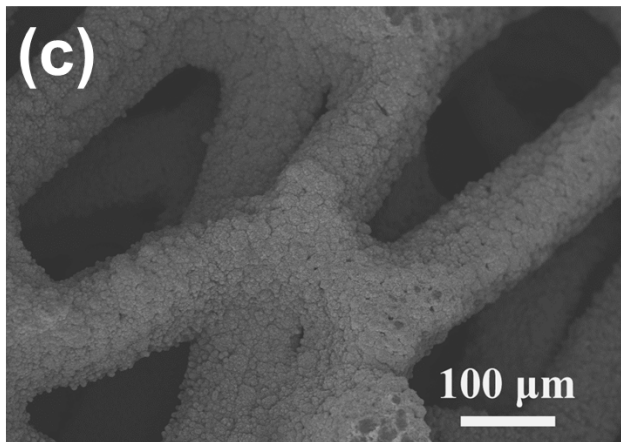
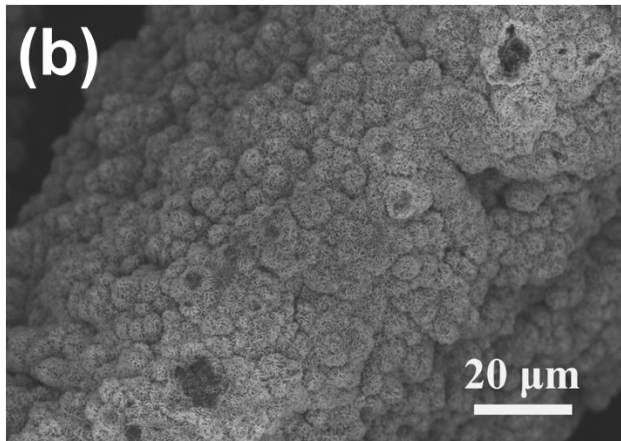
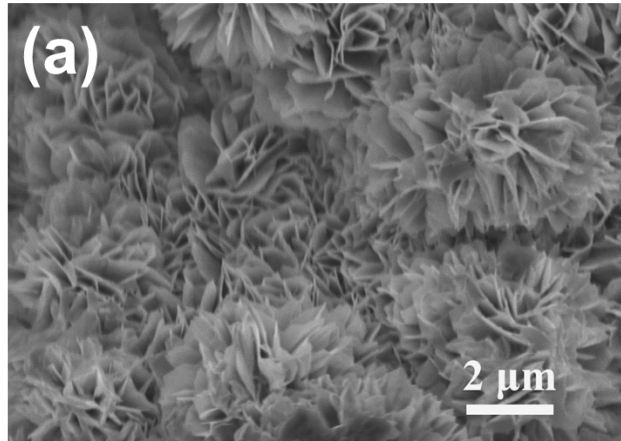


Figure S9 SEM images of NiS/WS<sub>2</sub>/Ni<sub>3</sub>S<sub>4</sub> after alkaline HER test.

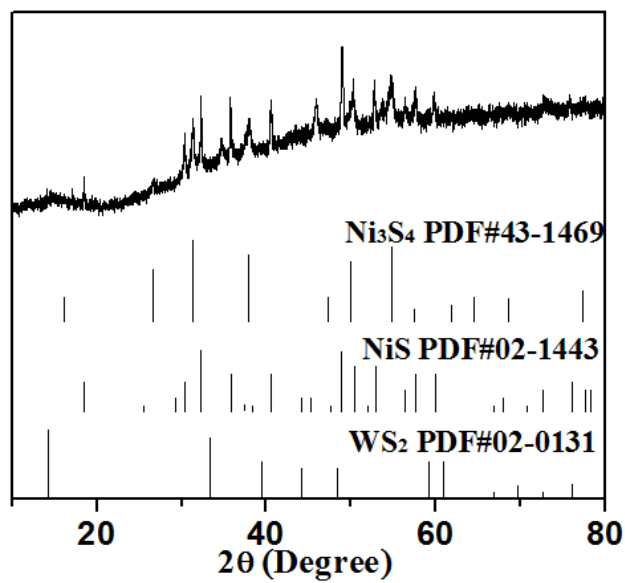


Figure S10 XRD pattern of NiS/WS<sub>2</sub>/Ni<sub>3</sub>S<sub>4</sub> after alkaline HER test.

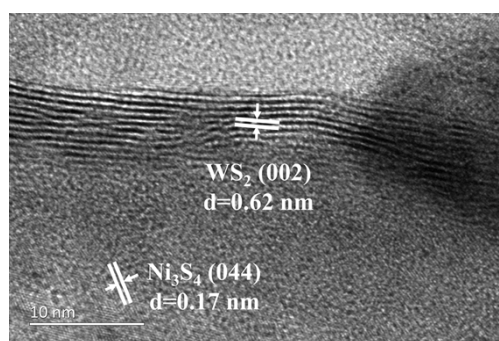


Figure 11 TEM image of of NiS/WS<sub>2</sub>/Ni<sub>3</sub>S<sub>4</sub> after alkaline HER test.