Supporting Information

A hollow core-shell structure material $NiCo_2S_4$@Ni_2P with uniform heterojunction for efficient photocatalytic H_2 evolution reaction

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1.

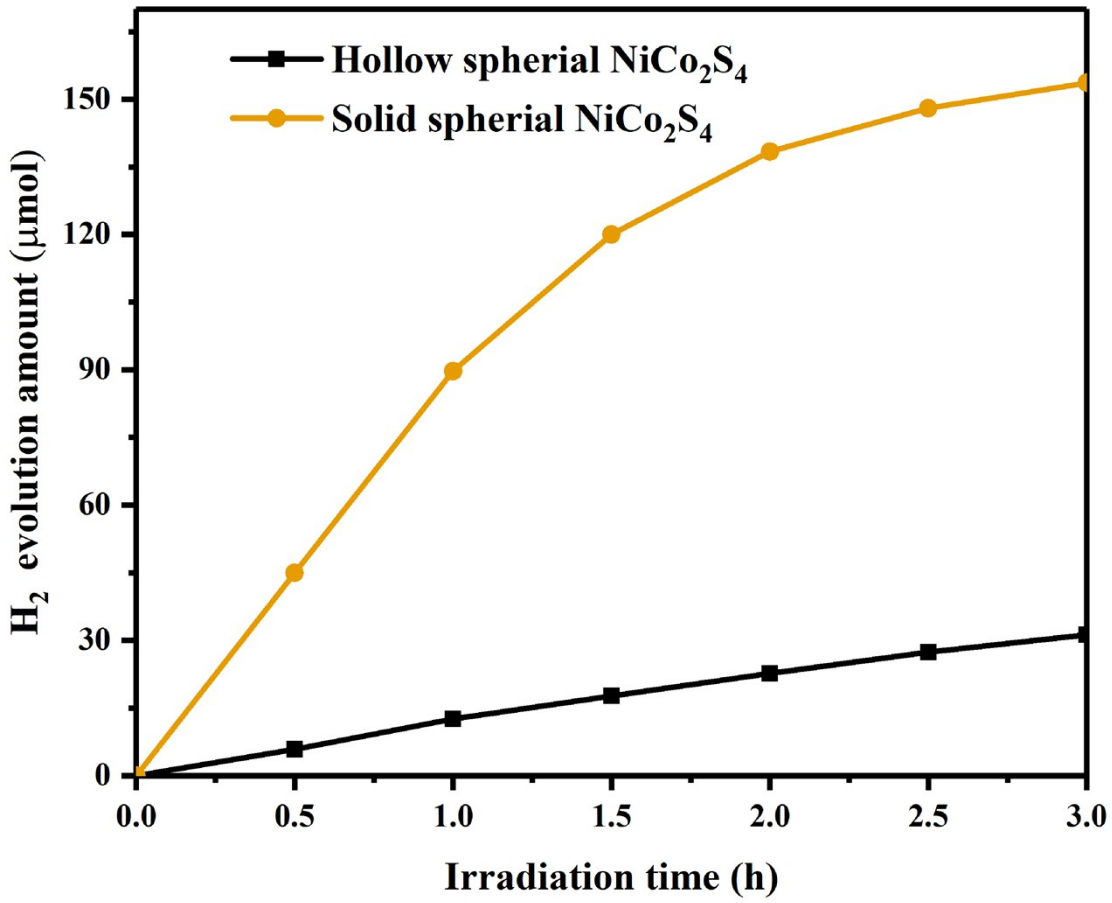

Fig. S1 H_2 evolution curves of solid spherical $NiCo_2S_4$ and hollow spherical $NiCo_2S_4$.

2.

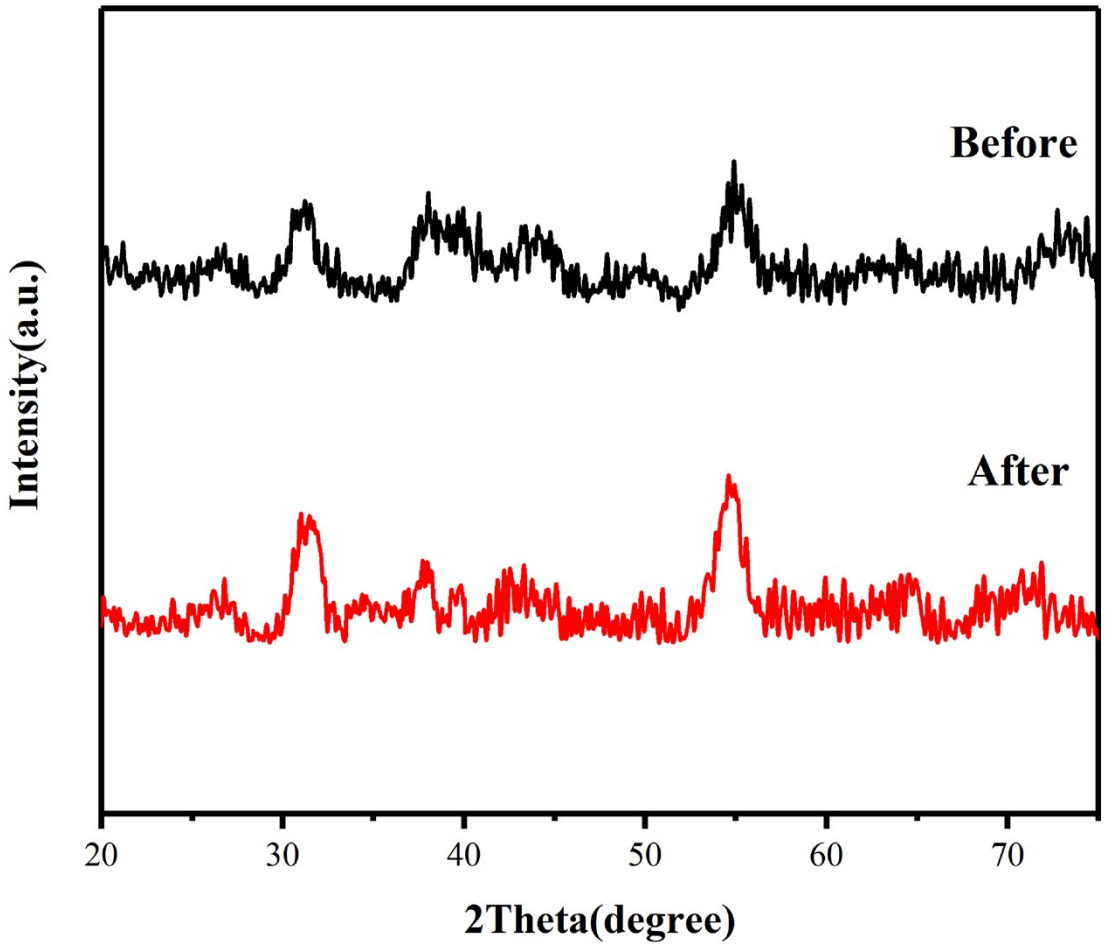

Fig. S2 XRD patterns of $NiCo_2S_4$@Ni_2P 10% before and after before and after stability tests (12h).

3. Band potential calculation

$$E_{CB} = X - Ec + 0.5Eg$$

$$E_{VB} = E_{CB} + Eg$$

In the above formulas, X is the absolute electronegativity of the calculated material; Eg is the band gap width of the material; E_{CB} and E_{VB} and the conduction band and valence band potential (VS.NHE) of the corresponding materials respectively; E_c is the difference value from standard hydrogen electrode and vacuum level (about 4.5eV). Eg value of $NiCo_2S_4$ is derived from the UV-vis DRS tests. A number of previous reports have shown that the Eg value of Ni_2P is about 1.0eV.

Pearson Absolute Electronegativity of different elements comes from the following

database:

http://www.knowledgedoor.com/2/elements_handbook/pearson_absolute_electronegativity.html#opennewwindow?tdsourcetag=s_pcqq_aiomsg

$NiCo_2S_4$:

$X= [x(Ni) * x(Co)^2 * x(S)^4]^{1/7}=[x(4.40) * x(4.30)^2 * x(6.22)^4]^{1/7}=5.32\ eV$

$E_g = 2.49eV$

$E_{CB}=X-E_c-0.5E_g=5.32-4.5-0.5*2.49=-0.42eV$

$E_{VB}=E_{CB}+E_g= -0.42+2.49=2.07eV$

Ni_2P:

$X= [x(Ni)^2 * x(P)]^{1/3}=[x(4.40)^2 * x(5.62)]^{1/3}=4.77\ eV$

$E_g=1.00eV$

$E_{CB}=X-E_c-0.5E_g=4.77-4.5-0.5*1.00=-0.23eV$

$E_{VB}=E_{CB}+E_g=-0.23+1.00=0.77eV$