

## Supporting information

### Rational design of $\text{Ni}_x\text{Co}_{1-x}\text{P}@C$ cocatalyst for enhanced overall water splitting based on g- $\text{C}_3\text{N}_4$ photocatalyst — the synergy of carbon-shell modification and bimetal modulation

Tingfeng Zhang#, Xuefang Lan#, Lili Wang, Jinsheng shi, kefeng Xiao\*

Qingdao Agricultural University, Department of Chemistry and Pharmacy, China

\* Corresponding author at: Qingdao Agricultural University, Department of Chemistry and Pharmacy, Chengyang District, Qingdao, China

E-mail address: jsshqn@aliyun.com

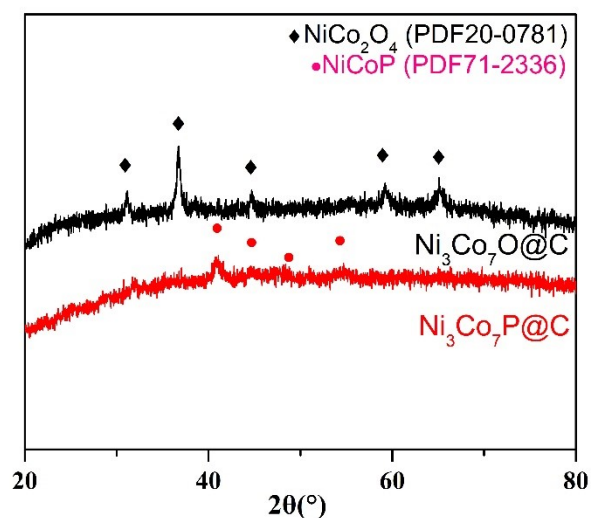


Fig. S1 XRD patterns of  $\text{Ni}_3\text{Co}_7@C$  after oxidation and phosphidation

Table S1 ICP results of co-catalyst and catalyst

Samples	Co(wt%)	Ni(wt%)	NDCS	P(wt%)	S(wt%)	Co/Ni
5%Ni <sub>3</sub> Co <sub>7</sub> P/CN	1.06	0.48%	--	1.57	0.071	2.2
Ni <sub>7</sub> Co <sub>3</sub>	20.55	42.81%	36.64	--	--	0.48
Ni <sub>5</sub> Co <sub>5</sub>	35.91	32.65%	31.44	--	--	1.1
Ni <sub>3</sub> Co <sub>7</sub>	45.12	19.61%	35.27	--	--	2.3

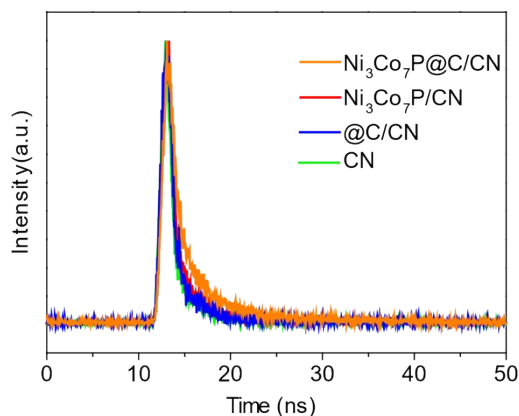


Fig. S2 Transient PL spectra of g-C<sub>3</sub>N<sub>4</sub>, @C/CN, Ni<sub>3</sub>Co<sub>7</sub>-P/CN and Ni<sub>3</sub>Co<sub>7</sub>-P@C/CN  
The transient PL spectra show increasing fluorescent lifetime in the order g-C<sub>3</sub>N<sub>4</sub> < @C/CN < Ni<sub>3</sub>Co<sub>7</sub>-P/CN < Ni<sub>3</sub>Co<sub>7</sub>-P@C/CN, indicating the increasing carrier separation and transfer efficiency in the same order., which is consistent with the steady-state PL results.