

Supporting Information

Efficient solar-driven nitrogen fixation over an elemental phosphorus photocatalyst

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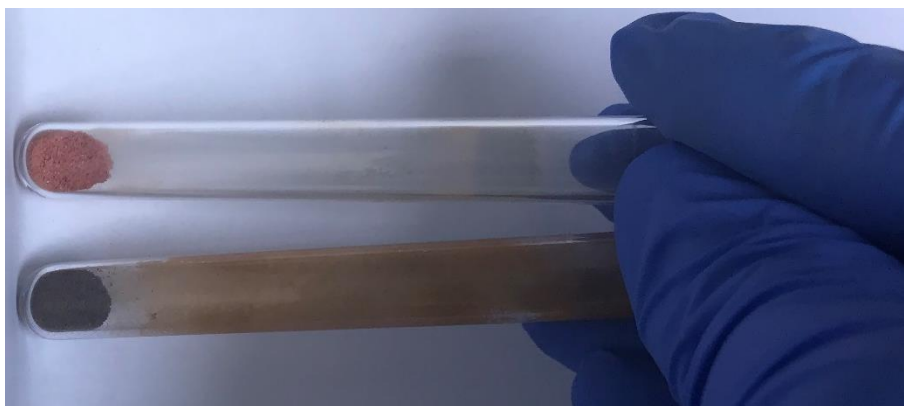


Fig. S1. Photograph of the as-synthesized bulk RP and SiO₂/C-RP samples in quartz ampoule.

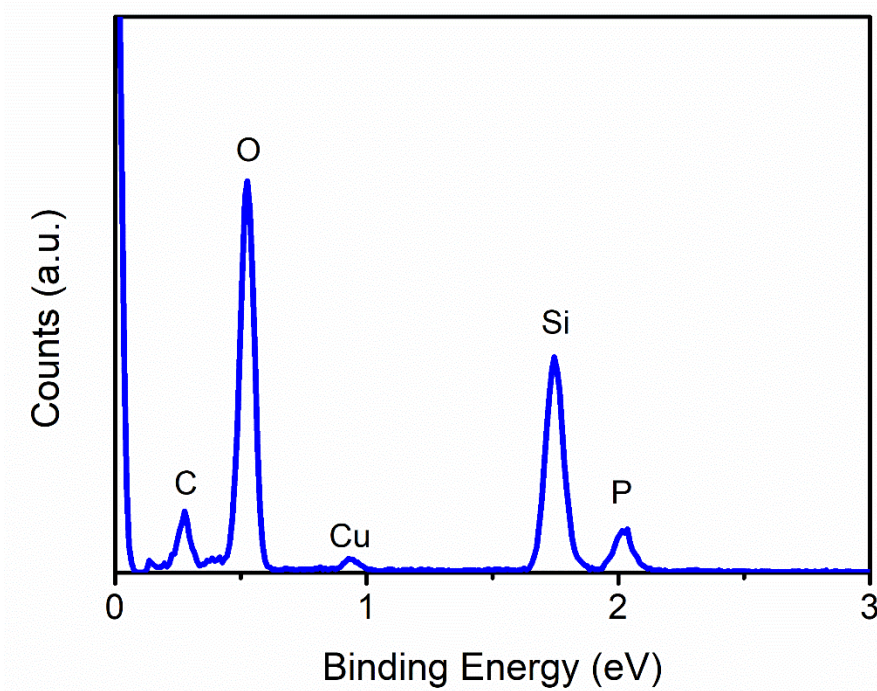


Fig. S2. EDS spectrum of the SiO₂/C-RP nanocomposite.

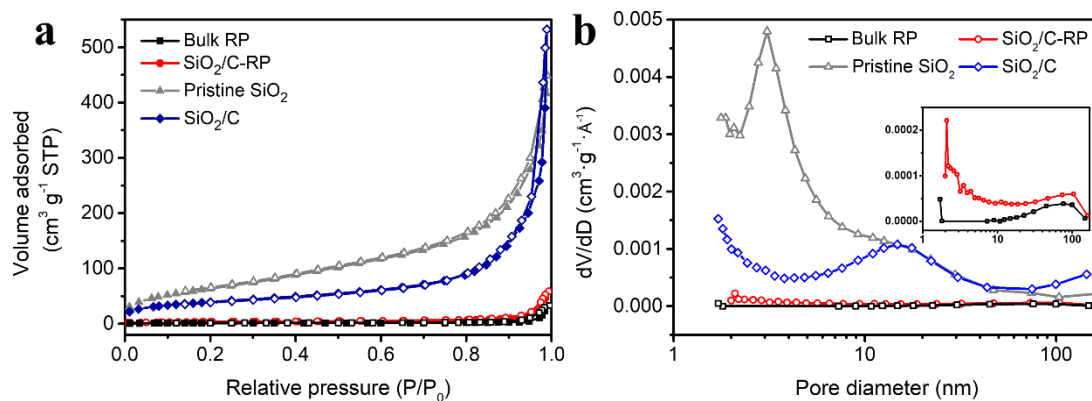


Fig. S3. a) N₂-sorption isotherms and b) BJH pore-size distributions.

Table S1. Summary of BET surface areas and BJH pore volumes of different samples.

Sample	S_{BET} (m ² g ⁻¹)	V_{BJH} (m ³ g ⁻¹)
Bulk RP	3.70	0.05
SiO₂/C-RP	11.92	0.09
Pristine SiO₂	237.27	0.70
SiO₂/C	141.20	0.81

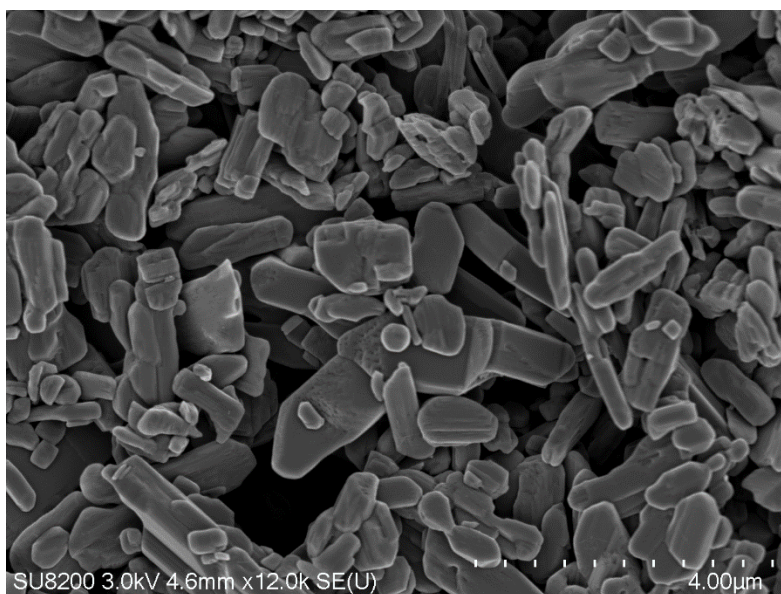


Fig. S4. SEM image of bulk RP sample.

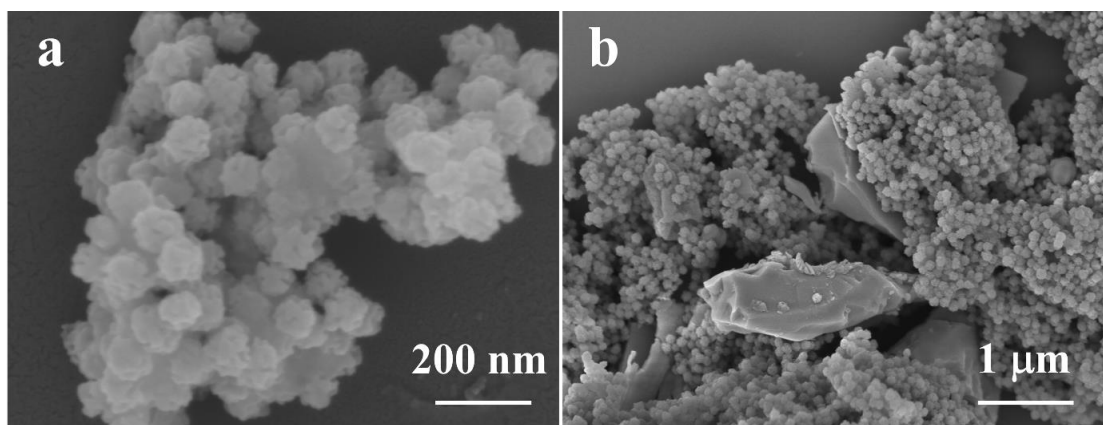


Fig. S5. SEM images of air calcined-SiO₂ and SiO₂-RP.

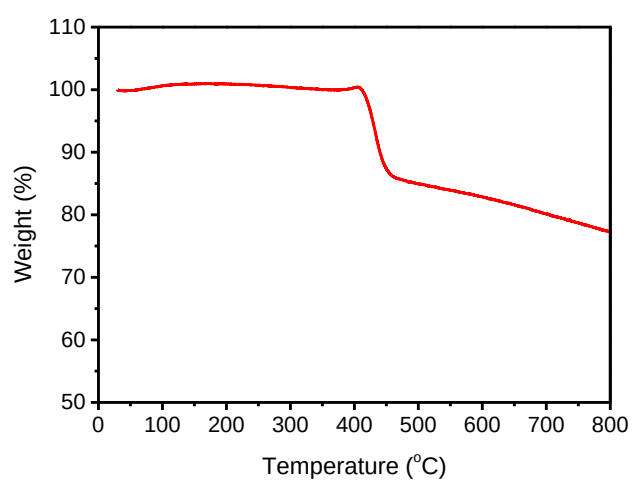


Fig. S6. TGA of SiO₂/C-RP sample under N₂ atmosphere.

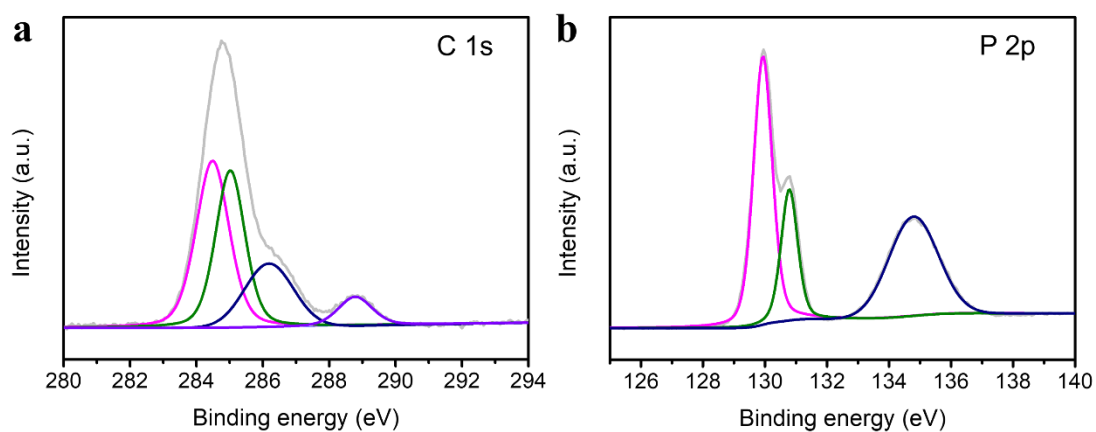


Fig. S7. High-resolution XPS spectra of a) C 1s and b) P 2p.

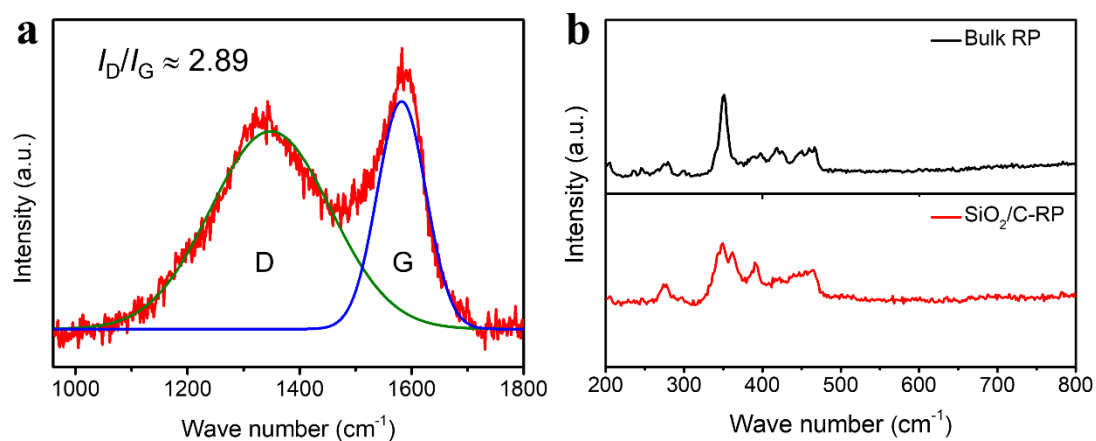


Fig. S8. (a) Raman spectra of SiO₂/C-RP representing the D-band and G-band of carbon and (b) Raman spectra of bulk RP and SiO₂/C-RP representing the characteristic peaks of RP.

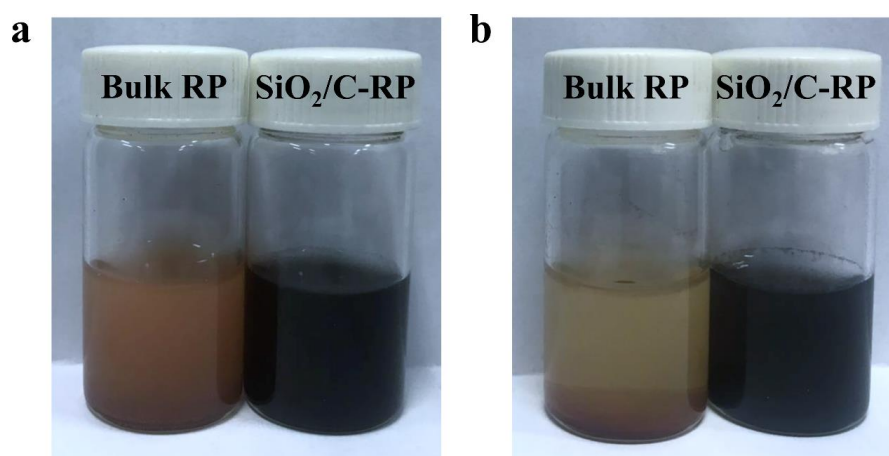


Fig. S9. Photographs of aqueous dispersions of bulk RP and SiO₂/C-RP catalysts: a) just after 30 min of sonication and b) after standing for 120 min.

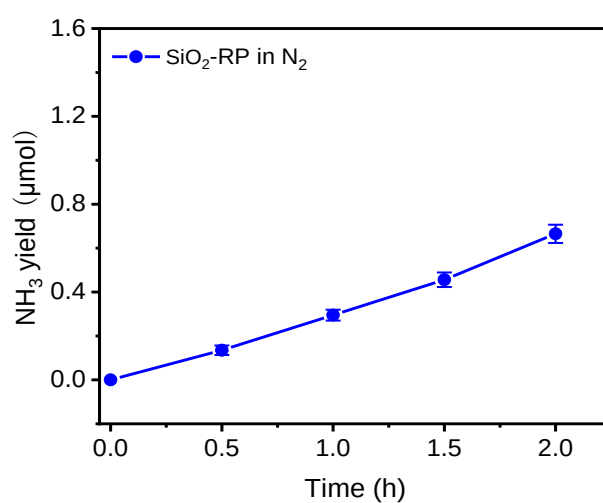


Fig. S10. Photocatalytic N₂ fixation rates of SiO₂-RP.

Table S2. Summary of photocatalytic NRR rates over various photocatalysts in pure water without using any sacrificial agent under full-spectrum irradiation.

Catalysts	Catalyst mass (mg)	Solution volume (mL)	Light source&Light intensity	R_{ammonia} [$\mu\text{mol h}^{-1}$]	Ref.
SiO ₂ /C-RP	20	40	300 W Xenon lamp 320 mW cm ⁻²	0.73	This work
BiOBr-001-OVs	50	100	300 W Xenon lamp	11.16	S1
CuCr-LDH nanosheets	50	20	300 W Xenon lamp	3.69	S2
NiCr-LDH nanosheets				1.13	
Mo-doped W ₁₈ O ₄₉	10	10	300 W Xenon lamp 200 mW cm ⁻²	0.62	S3
C-modified WO ₃ ·H ₂ O	50	—	Xenon lamp 500 mW cm ⁻²	10.29	S4
BiO quantum dots	50	200	500 W Xenon lamp	61.3	S5
6% Cu-TiO ₂ nanosheets	20	20	300 W Xenon lamp 4.46 W cm ⁻²	1.58	S6
Oriented Bi/Bi ₂ WO ₆	50	100	300 W Xenon lamp	4.3	S7
MoO _{3-x} nanobelts	50	100	300 W Xenon lamp	0.055	S8
Mo-PCN SACs	3	6	300 W Xenon lamp	0.15	S9
0.5% Cu-ZnAl-LDH	5	100	300 W Xenon lamp 5.1 mW cm ⁻²	0.55	S10
Amorphous-CeO _x	50	100	300 W Xenon lamp	5.45	S11
30 wt % SV-1T-MoS ₂ /CdS	20	100	Xenon lamp	1.92	S12

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