

Electronic Supplementary Information

Metal free earth abundant elemental red phosphorus: A new class of visible light photocatalyst and photoelectrode material

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Dark reaction (with catalyst) and light reaction (without catalyst)

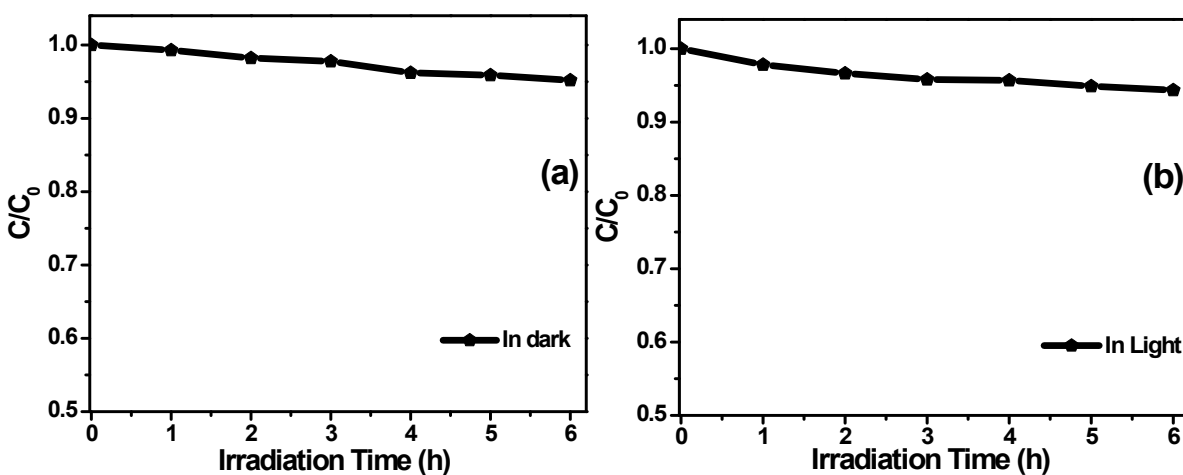


Fig. S1 The C/C_0 versus irradiation time (h) plots for RhB degradation **(a)** Dark reaction (with catalyst) and **(b)** light reaction (without catalyst).

BET analysis

Table S1. Surface area of red P milled for various times.

Sample	BET Surface area
0h	2.0613 m ² /g
12h	3.1248 m ² /g
24h	3.9426 m ² /g
36h	4.4176 m ² /g
48h	3.1244 m ² /g

Optical band gap energy of RP-0h and RP-36h

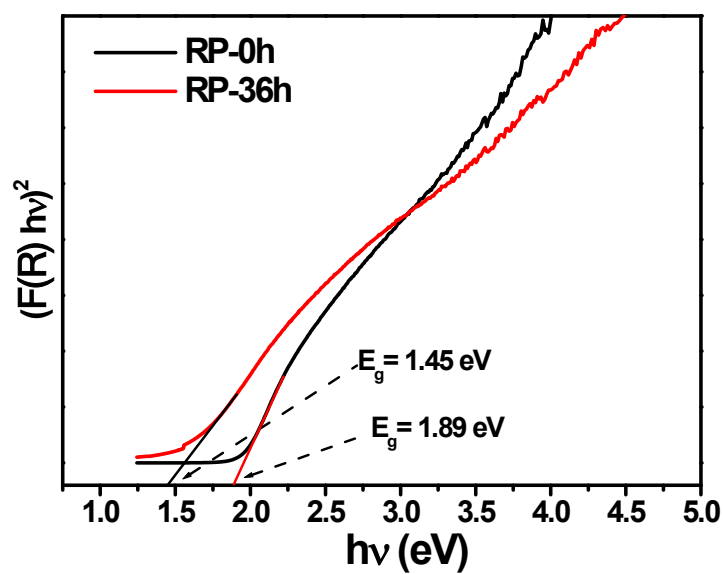


Fig. S2 Optical band gap obtained from the Kubelka-Munk functions versus the band gap energy plot of RP-0h and RP-36h.

Plot for the degradation of 2-CP over RP-0h and RP-36h under visible photoirradiation

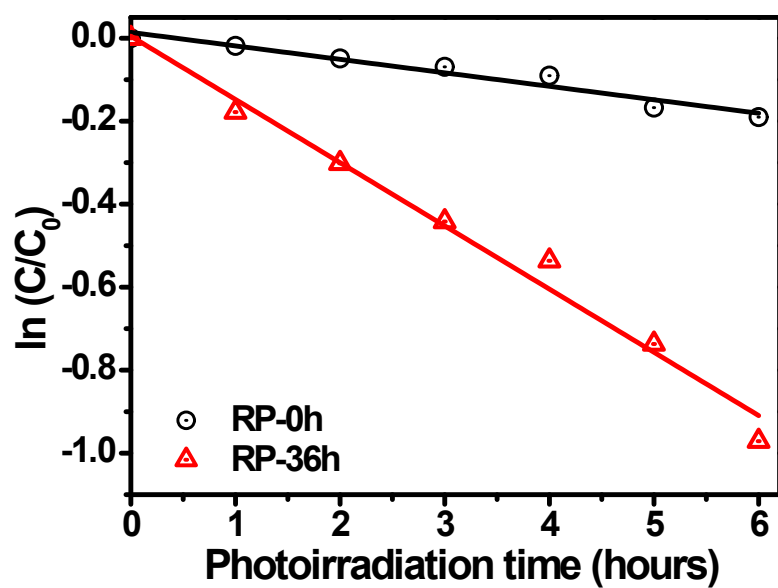


Fig. S3 $\ln(C/C_0)$ versus time (h) plot for the degradation of 2-CP over RP-0h and RP-36h under visible photoirradiation.

EIS Nyquist plots of the RP-12h and RP-24h photoelectrodes

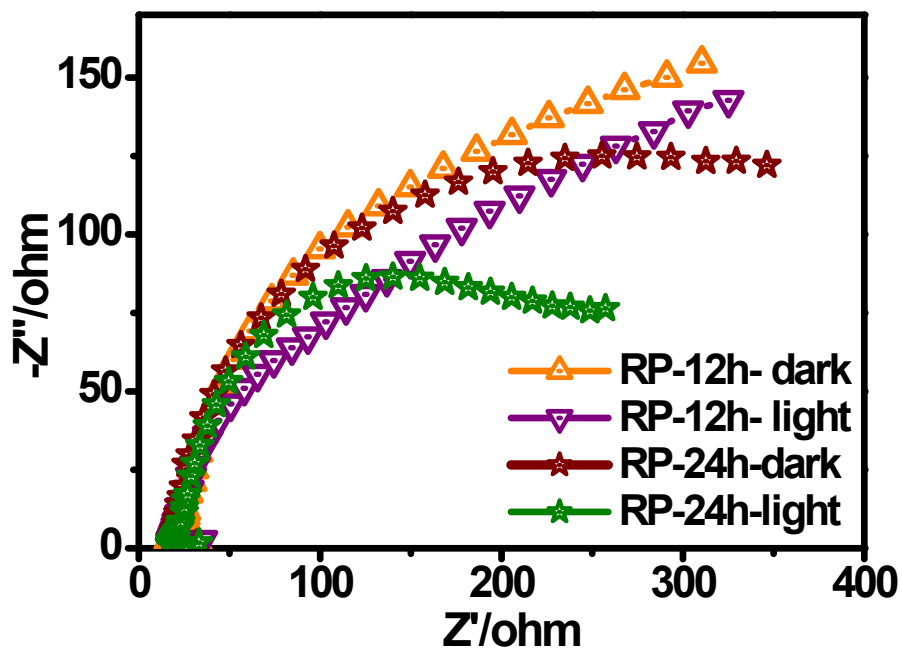


Fig. S4 EIS Nyquist plots of the RP-12h and RP-24h photoelectrodes in the dark and under visible photoirradiation.

XRD pattern of RP-3h after the degradation reaction

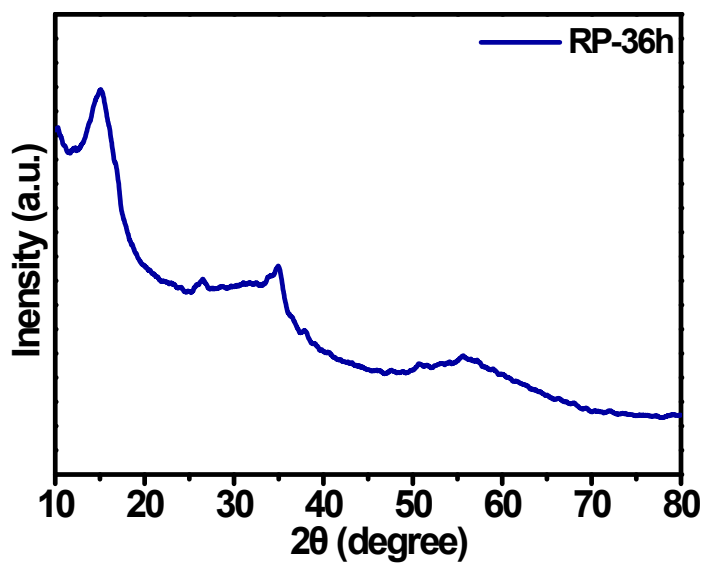


Fig. S5 XRD pattern of RP-36h after the degradation reaction.

UV-visible diffuse reflectance spectra of RP

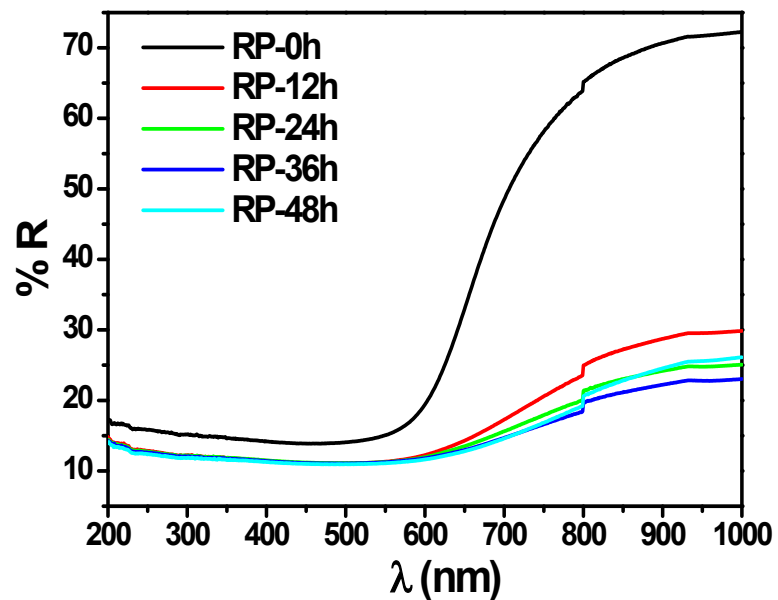


Fig. S6 UV-visible diffuse reflectance spectra of unmilled (RP-0h) and milled RP for different times (RP-12, RP-24, RP-36, and RP-48h).

TEM image of the RP-0h, RP-12h, RP-24h, and RP-48h

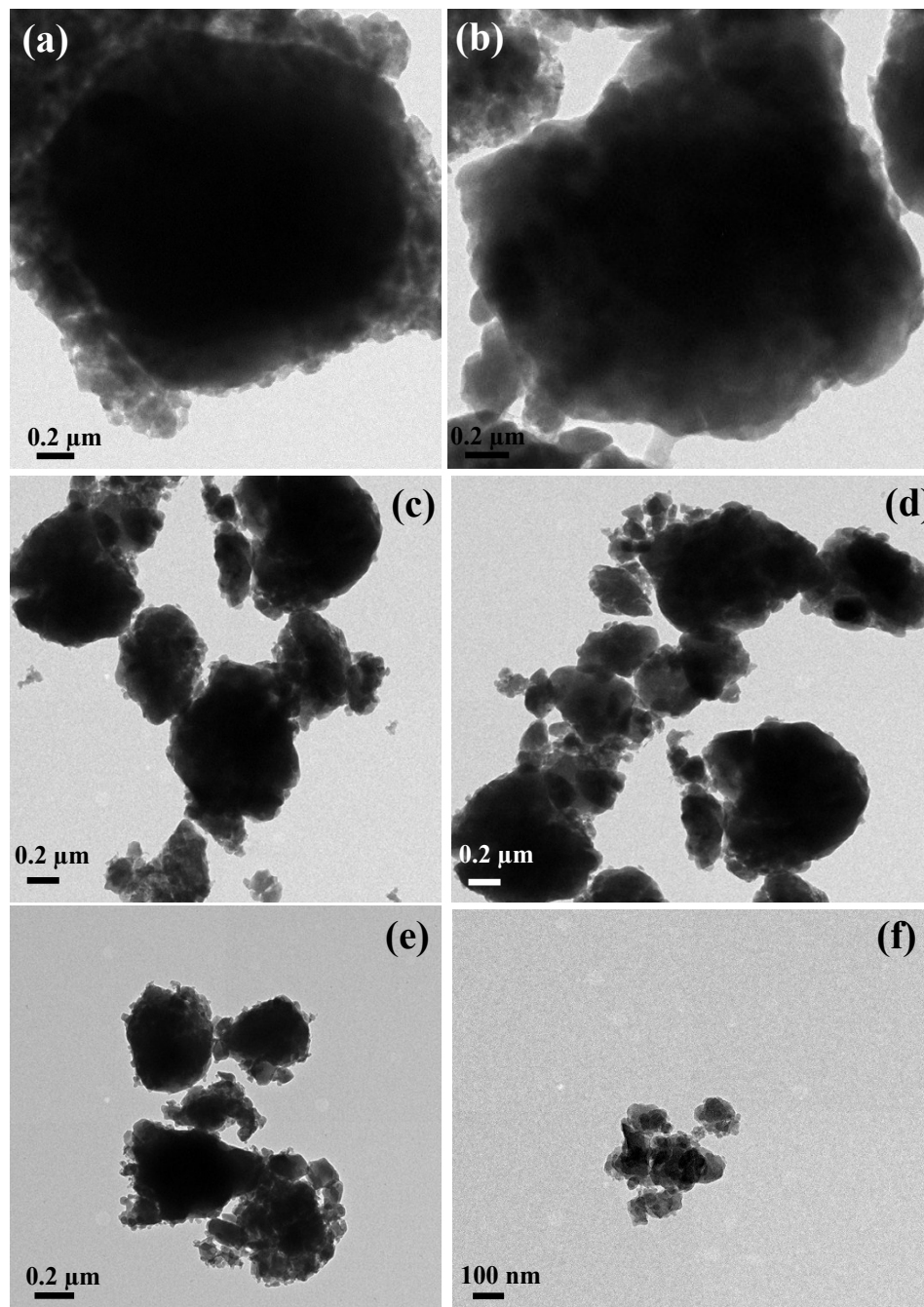


Fig. S7 TEM image of the (a and b) RP-0h, (c and d) RP-12h, (e) RP-24h, and (f) RP-48h.

TEM and HR-TEM images of the RP-36h

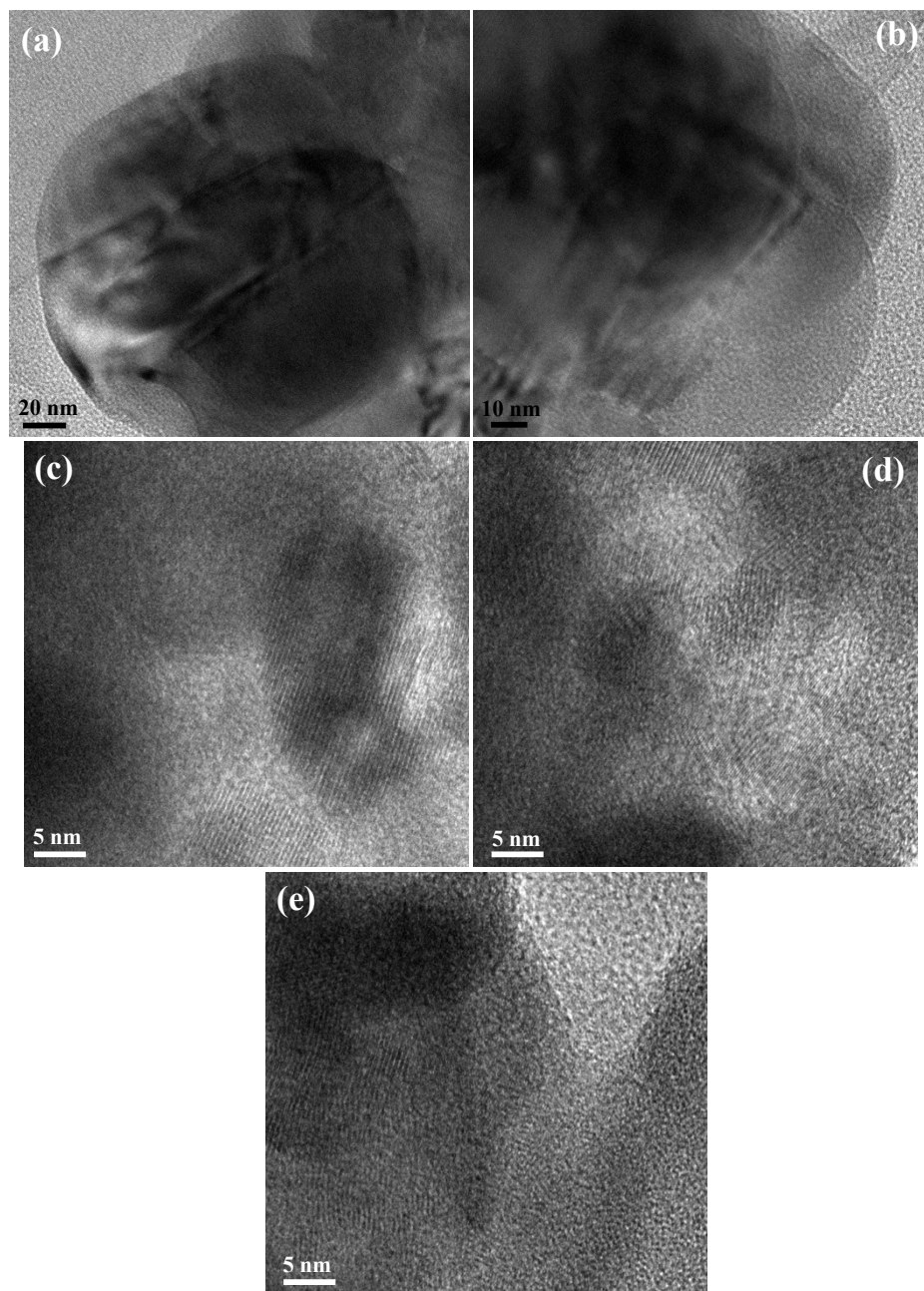


Fig. S8 TEM and HR-TEM images of the RP-36h at different place.

P 2p core level XPS spectra of RP-36h

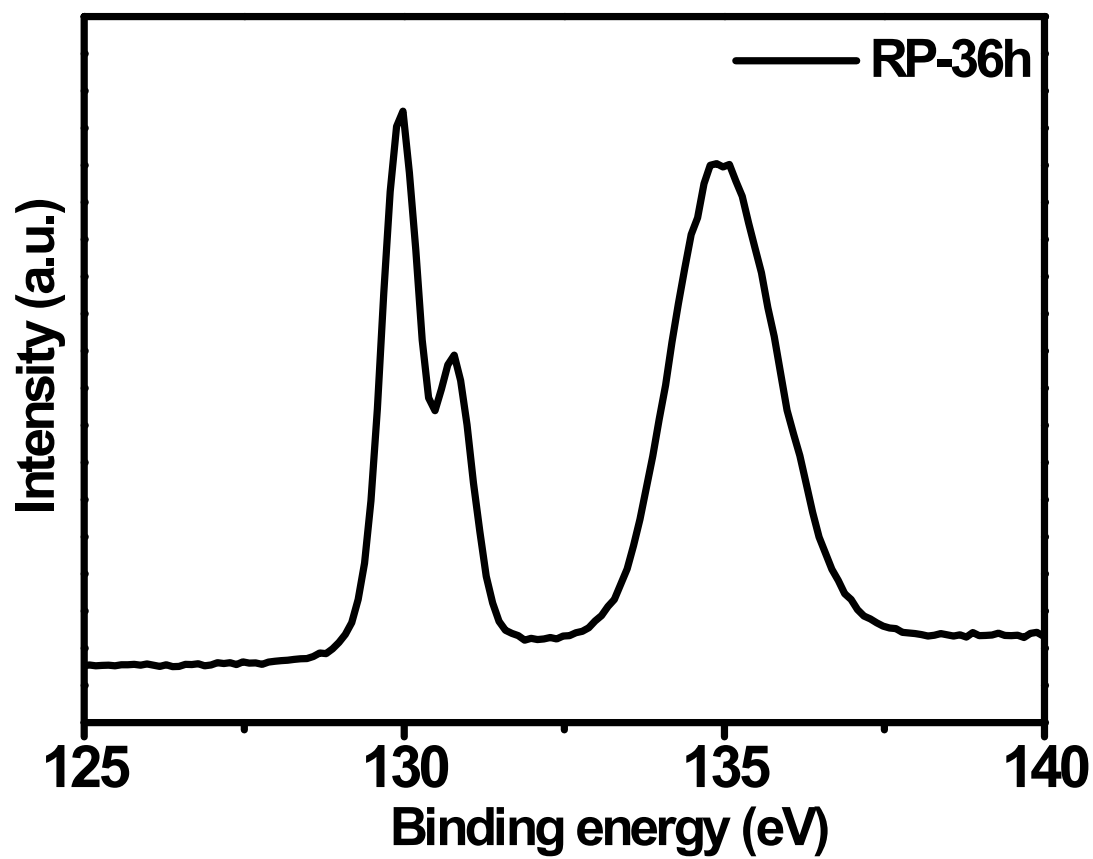


Fig. S9 P 2p core level XPS spectra of RP-36h after degradation reaction.