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Electronic Supplementary Materials

Three-dimensional graphitic carbon nitride belt network for enhanced visible light photocatalytic hydrogen evolution

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Table S1 Atomic percentage obtained from XPS spectra of bulk g-C_3N_4 and g-C_3N_4 NB.

Samples	C (%)	N (%)	O (%)	C/N
bulk g-C_3N_4	41.59	56.99	1.42	0.73
bulk g-C_3N_4	42.32	53.08	4.60	0.80

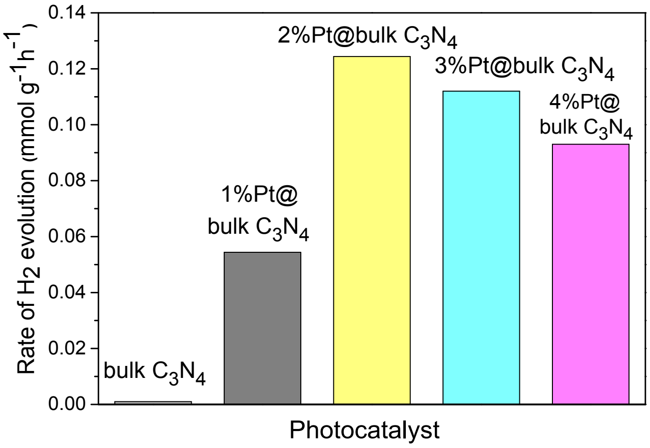

Fig. S1 HER of bulk g-C_3N_4 loaded with various content Pt under visible light (λ>420 nm) using 10% TEOA as sacrificial agent.

Determination of apparent quantum efficiency

The apparent quantum efficiency (AQE) for 3wt% Pt@g-C_3N_4 NB was measured under the same photocatalytic reaction condition and the incident light was supplied by a 300W Xe lamp with specific band-pass filters to get the desired incident wavelength (420 nm). The catalyst solution was irradiated for 10 hours. The average intensity of irradiation was determined to be 3.58 mW·cm^{-2} and the irradiation area was 5.96 cm^2. The amount of H_2 molecules generated in 10 hours was 158.1 μmol. The quantum efficiency was calculated by Equation 1. The number of evolved H_2 molecules was calculated by Equation 2. The number of incident photons was 1.606×10^{21} as calculated by Equation 3.

$$\text{AQE[\%]} = \frac{\text{Number of reacted electrons}}{\text{Number of incident photons}} \times 100$$

$$= \frac{\text{Number of } H_2 \text{ molecules} \times 2}{\text{Number of incident photos}} \times 100 \text{ L L L L L L L } (1)$$

Number of H_2 molecules $= 6.02\times10^{23}\times158.1\times10^{-6} = 7.89\times10^{19}$ (2)

Number of incident photons $= E\lambda/hc = (3.58\times10^{-3}\times5.96\times3600\times10\times 420\times10^{-9}) / (6.626\times10^{-34} \times3\times10^{8}) = 1.62\times10^{21}$ (3)

The calculated AQE at 420 nm is 12%.

Table S2. Comparison g-C_3N_4 based composites for visible-light-driven photocatalytic HER using sacrificial agent as electron donor.

Photocatalysts	Light source Xe lamp (nm)	Sacrificial agent (vol %)	Activity (mmol/g/h)	AQE (%)
Pt/ g-C_3N_4 [S1]	300W $\lambda\geq420$	10 % TEOA	0.375	-
Pt/g-C_3N_4 [S2]	300W $\lambda\geq420$	10 % TEOA	1.150	-
Pt/g-C_3N_4 [S3]	300W $\lambda\geq400$	10 % TEOA	0.640	-
Pt/g-C_3N_4 [S4]	300W $\lambda\geq420$	10 % TEOA	0.230	-
Pt/g-C_3N_4 [S5]	125W $\lambda\geq400$	10 % TEOA	0.240	-
Pt/g-C_3N_4 [S6]	300W $\lambda\geq420$	10 % TEOA	0.098	0.58% 440 nm)
NiS/g-C_3N_4 [S7]	300W $\lambda\geq420$	15 % TEOA	0.482	4.4% (440nm)
Pt/$BiPO_4$/g-C_3N_4 [S8]	300W $\lambda\geq420$	10%methanol	1.110	-
Pt/g-PAN/g-C_3N_4 [S9]	300W $\lambda\geq400$	10 % TEOA	0.370	-
Ag_2O/g-C_3N_4 [S10]	300W $\lambda\geq420$	10 % TEOA	0.330	-
Pt/g-C_3N_4 [S11]	300W $\lambda\geq400$	10 % TEOA	0.604	-
Pt/g-C_3N_4 [S12]	300W $\lambda\geq400$	11 % TEOA	1.510	5.7%
Pt/g-C_3N_4 (our work)	300W $\lambda\geq420$	10 % TEOA	1.360	12%

H_2O_2 determination principle by the I_3^- method

H_2O_2 determination was realized according to I_3^- strategy.[S13] In detail, standard K_2MnO_4 solution (0.02M) was used to precisely titrate concentration of H_2O_2 according to equation (1):

$$2MnO_4^- + 5H_2O_2 + 6H^+ \longrightarrow 2Mn^{2-} + 8H_2O + 5O_2 \qquad (1)$$

Then prepare a suite of gradient concentration standard H_2O_2 solution. After added I^- anion completely reduces H_2O_2 molecule into H_2O in equation (2), and oxidation product I_3^- anion was quantitatively measured by UV-Vis spectra.

$$5H_2O_2 + 3I^- + 2H^+ \longrightarrow I_3^- + 2H_2O \qquad (2)$$

In the end, calculated the oxidation product H_2O_2 content derived from photocatalytic overall water splitting after centrifugation to remove photocatalyst.

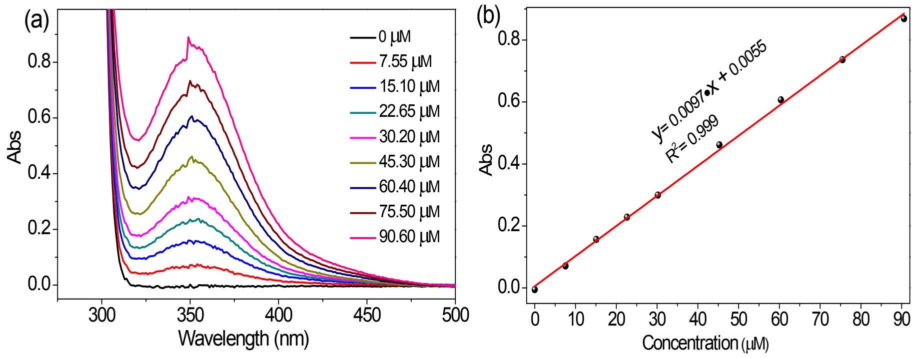

Fig. S2 (a) UV-Vis spectra of I_3^- by H_2O_2 oxidation and (b) linear fitting curve.

Accurate analysis of aqueous trace H_2O_2 concentration as low as μM can be done by I_3^- method, based on the spectrophotometric determination of I_3^- formed when H_20_2 added to a mixed concentrated solution of I^- and potassium acid phthalate. In the UV-Vis spectrum in Fig. S2a, maximum absorption peak at ca. 351 nm was unique characteristic peak of I_3^-, thus in accordance with a series of gradient concentration I_3^- solution acquires Abs function I_3^- concentration in Fig. S2b.

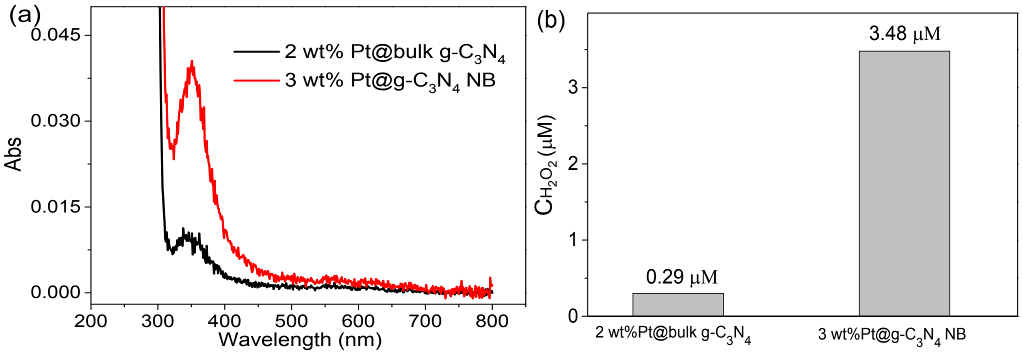

Fig. S3 (a) UV-Vis spectra of I_3^- by H_2O_2 oxidation from photocatalytic overall water splitting of 3 wt%@g-C_3N_4 NB under visible light illumination ($\lambda > 420$ nm) and (b) corresponding H_2O_2 concentration. (Conditions: 20 mg photocatalyst, reaction hour: 1 hour)

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