Supplementary Information

Hydrothermally Activated TiO_2 Nanoparticles with C-dots/g-C_3N_4 Heterostructure for Photocatalytic Enhancement

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Preparation of raw materials

(1) C-dots and g-C_3N_4

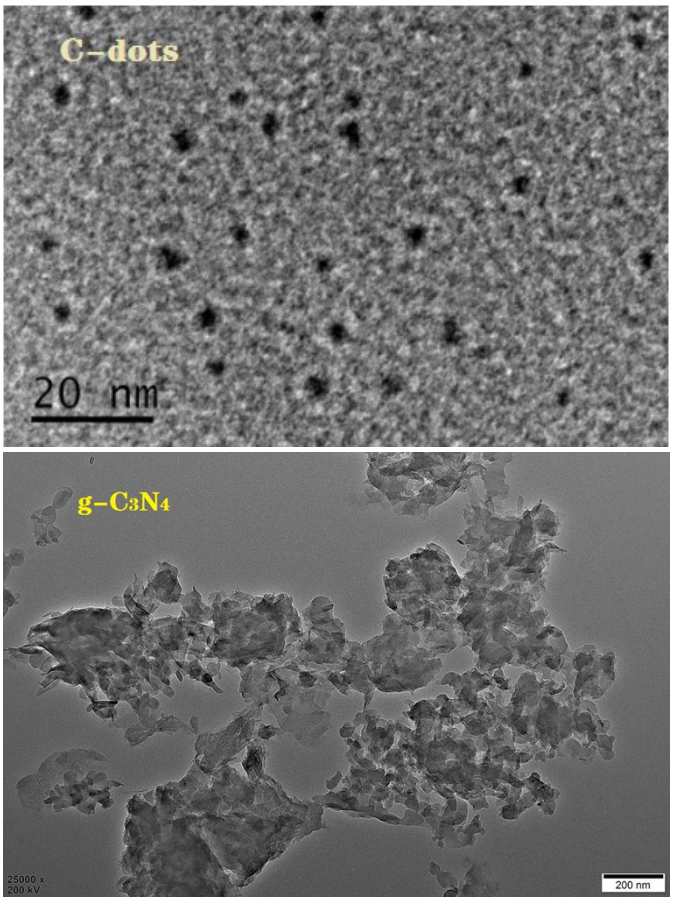
C-dots were synthesized by modifying the method from our previous report [1]. Typically, 20 g of citric acid monohydrate was dissolved into a Teflon tank containing 7 mL of D.I. water, then 6 mL of ethylenediamine was slowly added with stirring till the suspension become viscous. The Teflon tank was transferred to an autoclave and heated at 180 ºC for 20 h. After cooling down to room temperature naturally, the mixture was firstly poured into a beaker containing 200 mL absolute ethanol and waited for sedimentation of 1 day. The C-dots were obtained after centrifugally washing by D.I and vacuum drying under 80 ºC for 24 h. g-C_3N_4 was simply prepared by heating melamine in air at 550 °C for 5 h in a Muffle furnace.

(2) C-dots/g-C_3N_4 composite

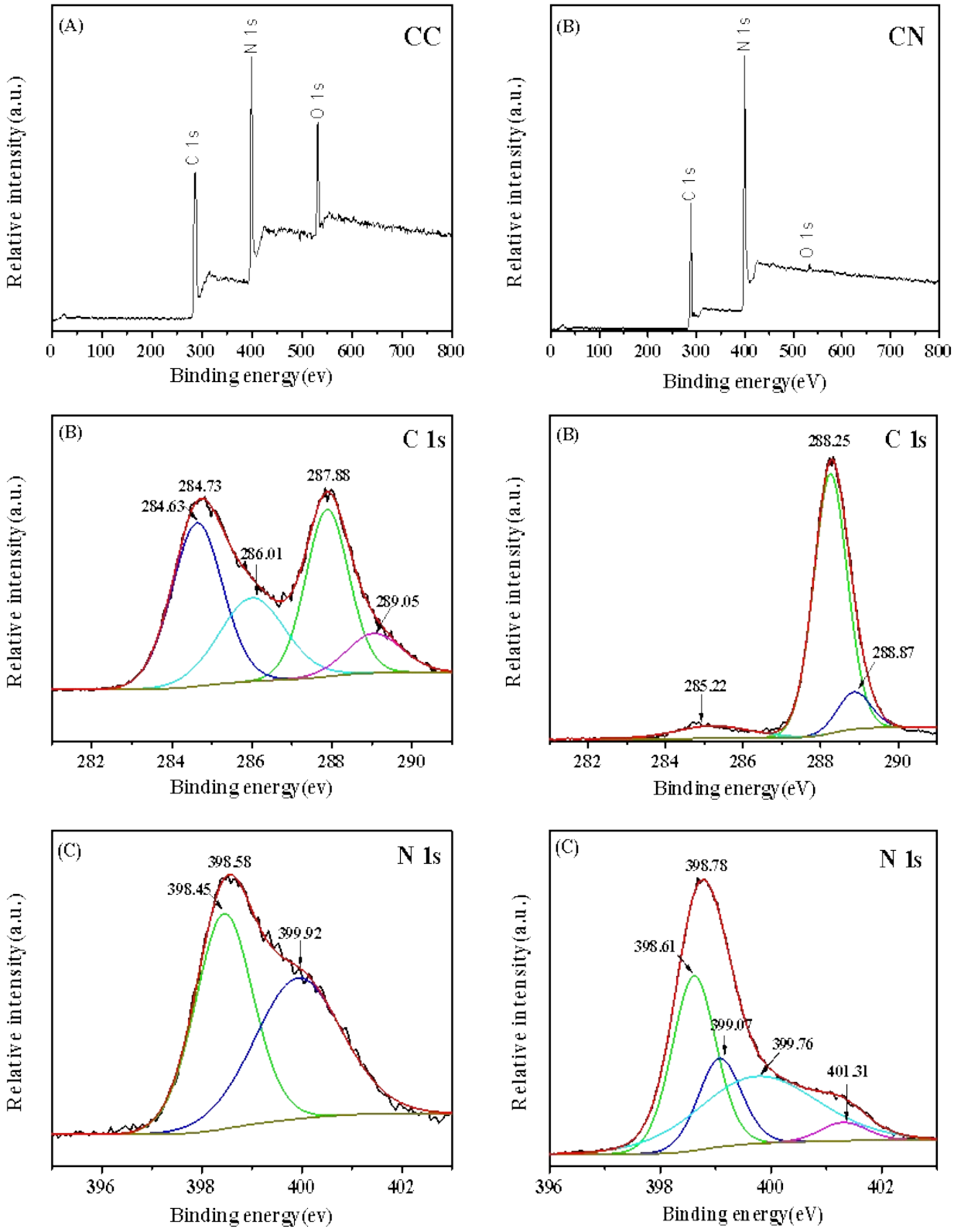
The CC composite was prepared through a hydrothermal impregnation process. 0.3 g of C-dots was mixed with 1 g of g-C_3N_4 by grinding in an agate mortar for 30 min, and then the mixed powder was added into a Teflon-lined autoclave containing 20 mL of D.I. water with vigorous stirring. The mixture was hydrothermally treated at 180 ºC for 20 h, followed by naturally cooled down to room temperature. Finally, the product CC was obtained under vacuum drying after centrifugally washing by water and ethanol several times.

Measurement results

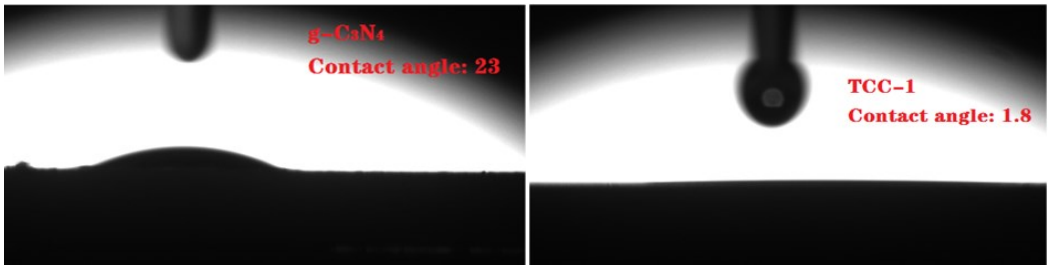
(1) TEM images of C-dots and g-C_3N_4



S-Fig. 1. TEM images of C-dots and g-C_3N_4.

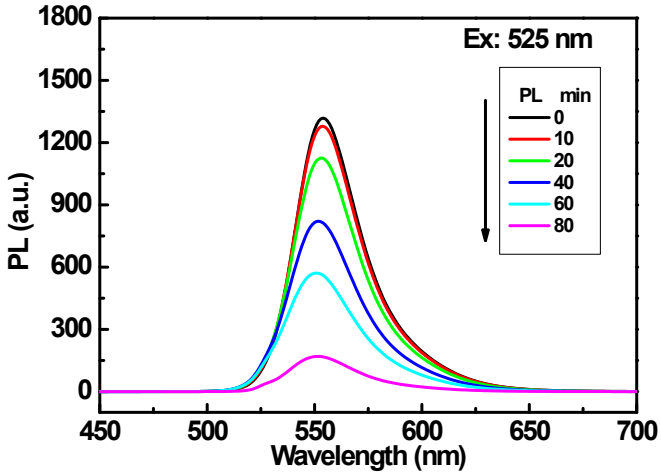


S-Fig. 2. XPS measurement results of CC (A-C) and g-C_3N_4 (D-F).

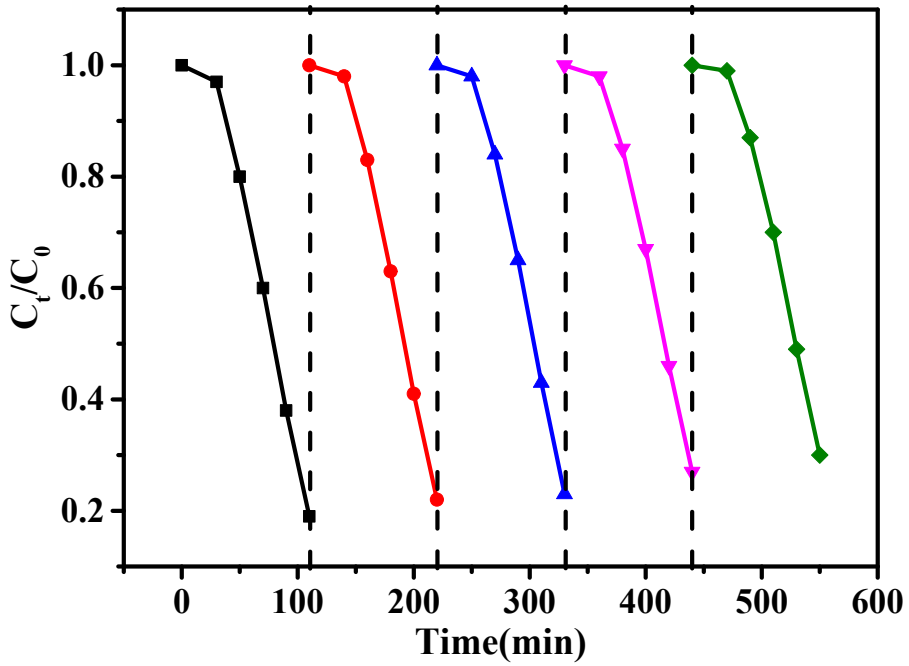


S-Fig. 3. Contact angle measurements of water drop on the surface of the thin films of g-C_3N_4 and TCC-1.

S-Fig. 4 shows PL spectra of RhB in aqueous solution with original concentration of 1.0×10^{-5} M after photocatalytic degradation of 10.0 mg TCC-1 powder under different light-irradiation time, using 15 W mercury-light partly with the wavelength of 365 nm. It should be stressed that after photocatalyzed for 80 min, the PL intensity has become about one seventh of that of original Rh B solution, inferring that to common organic dyes, the TCC-1 should display excellent photodegradation property.



S-Fig. 4. PL spectra of RhB aqueous solution under different light-irradiation period after photocatalysis of TCC-1.



S-Fig. 5. Repeated photocatalytic photodegradation of RhB by TCC-1 for the stability confirmation.

S-Table. 1. A comparison of recent reported TiO_2 and g-C_3N_4-based photocatalysts.

	Photocatalyst	Degradation materials	Degradation rate	k value	Active species	References
1	TiO_2/carbon quantum dots/ mesoporous g-C_3N_4	Gaseous benzene	96.08% after 120 mins	0.02726 min^{-1}	$\bullet O^{2-}$	[2]
2	TiO_2/single layer g-C_3N_4	RhB	95% after 150 mins	0.0107 min^{-1}	h^+	[3]
3	TiO_2 nanowire /g-C_3N_4/graphene	Nitrobenzene	97% after 4 hours	-	e^-	[4]
4	C-dots/g-C_3N_4	RhB	About 80% after 70 mins	0.013 min^{-1}	$\bullet O_2^-$	[5]
5	TiO_2/C-dots/g-C_3N_4	RhB & MB	83.3% after 80 mins	0.0233 min^{-1}	h^+	This work

Reference

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