

Supporting information

Atomic Single Layer Graphitic-C₃N₄ : Fabrication and Its High Photocatalytic Performance Under Visible Light Irradiation

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1 Experimental details

Preparation of N-TiO₂: 4 mL of tetrabutyl titanate and 2 mL glacial acetic acid were added into 25 mL ethanol under stirring. The obtained mixture was then combined with another solution composed of 15 mL water, 3 mL ethanol and 1.4 g urea. The sol turned to gel in oven at 80 °C for 8 h and then heated at 400 °C for 1.5 h.

Preparation of BiVO₄: 1.94 g Bi(NO₃)₃·5H₂O and 0.47 g NH₄VO₃ were mixed in a HNO₃ solution with the concentration of 1.84 M. The mixture was heated at 90 °C for 8 h.

Preparation of CdS: CdS was synthesized by a hydrothermal method at 200 °C for 8 h with the CdCl₂ and thiocarbamide as precursor. The molar ratio between CdCl₂ and thiocarbamide was 1:3 and the concentration of CdCl₂ was 1 mM.

Preparation of bulk g-C₃N₄: the fabrication procedure can be found in our previous work¹. 5g of melamine was heated at 520 °C for 4 h with the temperature increasing rate of 5 °C min⁻¹.

2 Morphology of samples

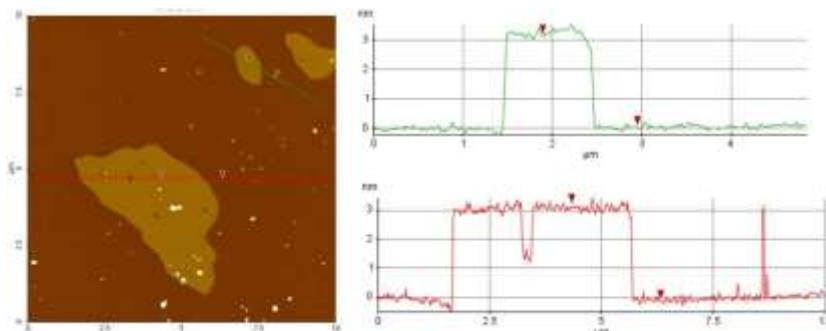


Figure S1 AFM image of g-C₃N₄ NS.

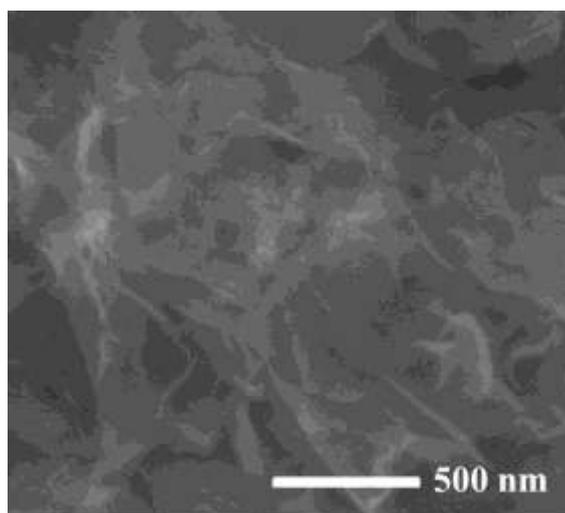
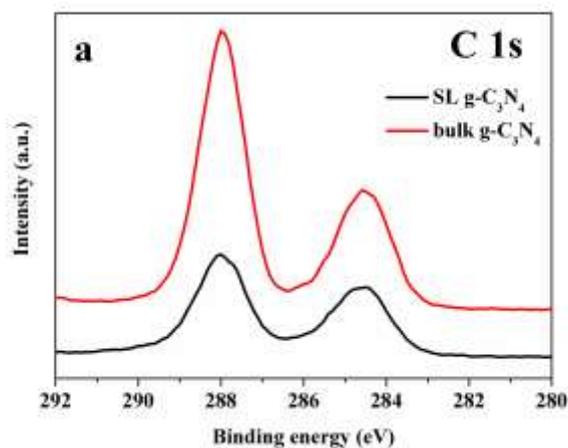


Figure S2 SEM image of SL g-C₃N₄.

3 The structure and component of the samples

The compositions and chemical states of both SL g-C₃N₄ and the bulk g-C₃N₄ were investigated by XPS and the results were shown in Figure S3. Figure S3 (a) shows the C 1s peak which can be deconvoluted into two peaks at 284.6 and 288.0 eV. The first peak was attributed to the graphitic carbon which came from the pure carbonaceous environment adsorbed on the surface. The second peak was assigned to carbon atoms bonded to three nitrogen atoms in the both bulk g-C₃N₄ and SL g-C₃N₄ lattice. In the N 1s spectrum (Figure S3 (b,c)) several binding energies can be separated. The main signal showed occurrence of C–N–C groups (398.5 eV) and tertiary nitrogen N–(C)₃ groups (399.3 eV). Deconvolution of the XPS signals also revealed a weak additional signal at 400.7 eV, indicative of amino functions carrying hydrogen (C–N–H). The peak at 404.1 eV was attributed to charging effects². Overall there were no obvious differences between bulk g-C₃N₄ and the SL g-C₃N₄ for both C 1s and N 1s XPS spectra which indicated the chemical states of both C and N in SL g-C₃N₄ were as same as in bulk g-C₃N₄.



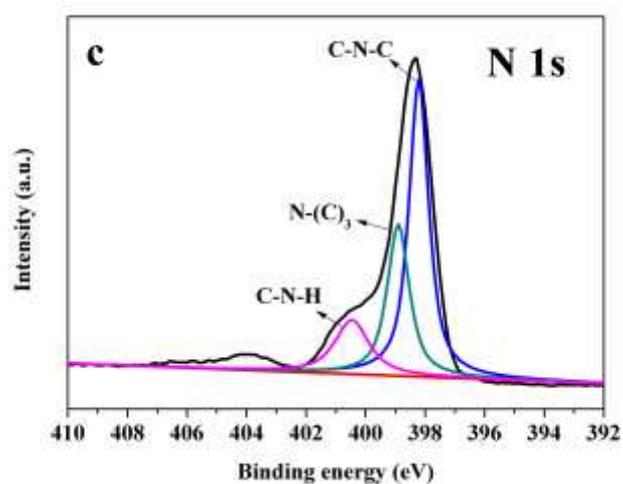
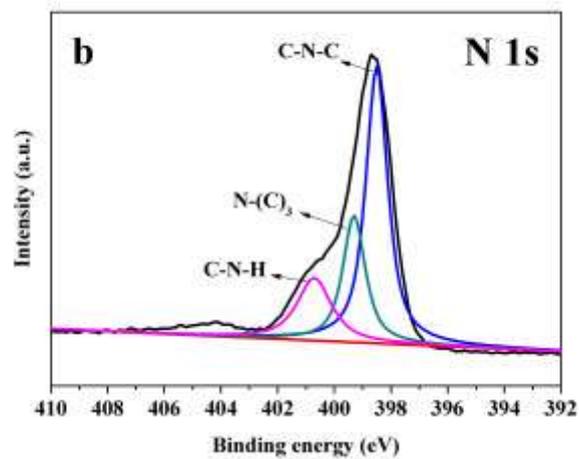


Figure S3 XPS spectra: (a) C 1s of bulk g-C₃N₄ and SL g-C₃N₄, (b) N 1s of bulk g-C₃N₄, (c) N 1s of SL g-C₃N₄.

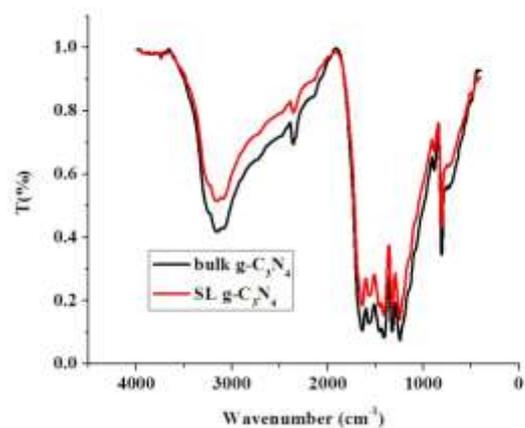


Figure S4 FTIR spectra of bulk g-C₃N₄ and the SL g-C₃N₄.

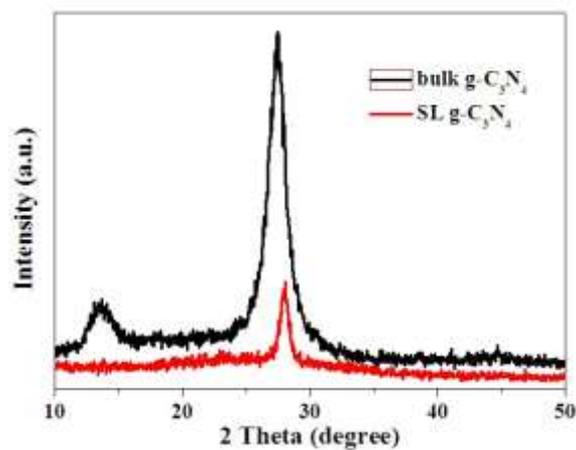


Figure S5 XRD patterns of bulk g-C₃N₄ and the SL g-C₃N₄.

4 Optical absorption

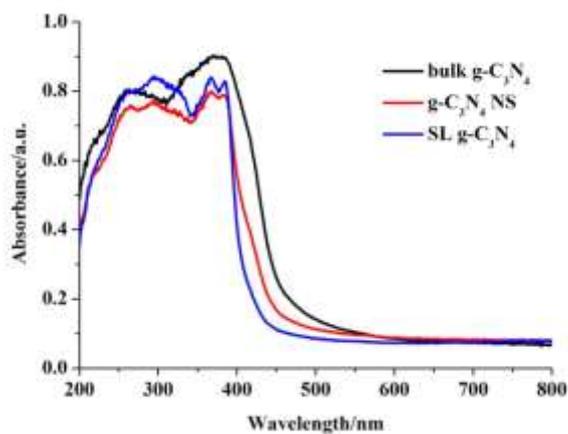


Figure S6 UV-visible absorption spectra of bulk g-C₃N₄, g-C₃N₄ NS and the SL g-C₃N₄

5 Mechanism of photocatalysis

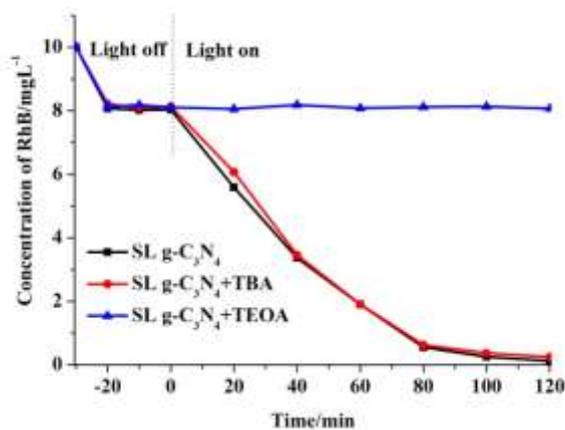


Figure S7 Photocatalytic degradation of RhB by SL g-C₃N₄ with different scavengers under visible light irradiation (λ > 400 nm).

6 Photocatalytic degradation of phenol

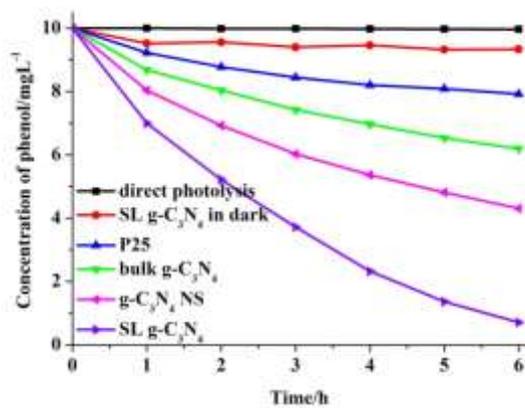


Figure S8 Photocatalytic degradation of phenol under visible light irradiation ($\lambda > 400$ nm).

References

- (1) Liao, G.; Chen, S. *J. Mater. Chem.* **2012**, *22*, 2721.
- (2) Thomas, A.; Fischer, A. *J. Mater. Chem.* **2008**, *18*, 4893.