Supporting Information

Improving photocatalytic hydrogen production of Ag/g-C_3N_4 nanocomposites by dye-sensitization under visible light irradiation

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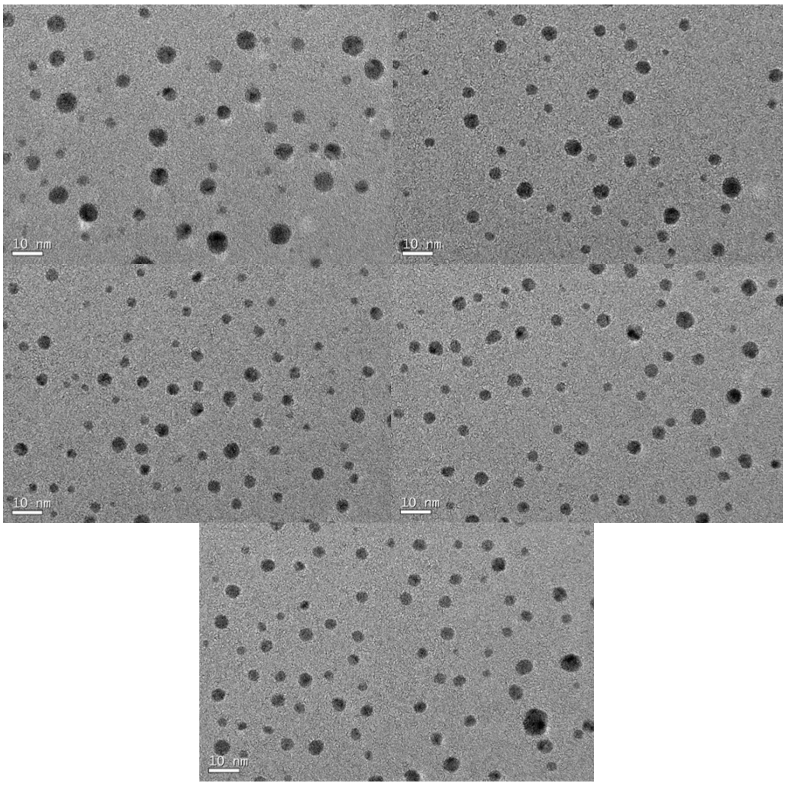


Fig. S1 TEM images provided for size distribution of Ag nanoparticles in 3SCN.

Table S1 Elemental composition of the CN in all the samples.

Samples	N%	C%	H%	C/N
$g\text{-}C_3N_4$	58.9	33.09	1.405	0.655
1SCN	57.81	32.53	1.886	0.656
3SCN	56	31.31	1.781	0.652
5SCN	54.6	30.68	1.784	0.656
7SCN	53.5	30.08	1.88	0.656
9SCN	53.2	29.91	1.643	0.656

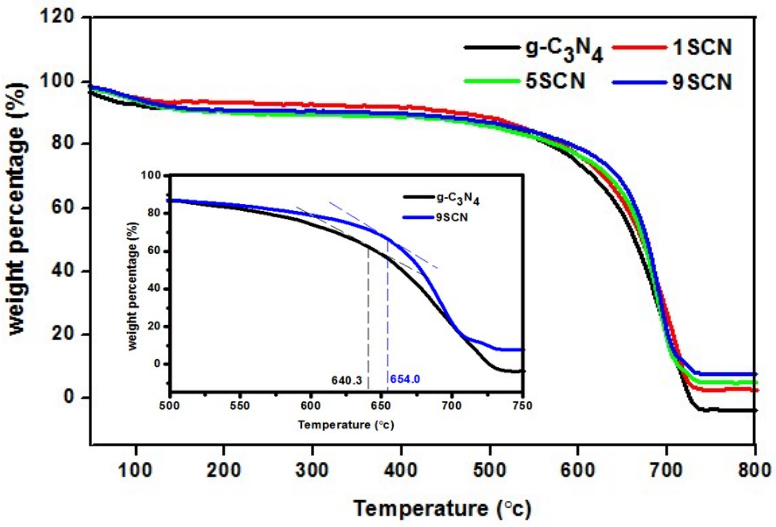


Fig. S2 TGA curves of pure g-C_3N_4, 1SCN, 5SCN and 9SCN. Inset shows the amplified curves of pure g-C_3N_4 and 9SCN.

Table S2 Contrast experiments for photocatalytic hydrogen generation.

Group	1.60 mg mL^{-1} $AgNO_3$ (mL)	g-C_3N_4 (mg)	3%Ag/g-C_3N_4 (mg)	Sacrificial agent (mL)		Water (mL)	PEG 2000 (g)	Fluorescein (mg)
				TEOA	EG			
1	5.00	—	—	10.0	—	60.0	1.0	—
	5.00	—	—	0	—	70.0	1.0	—
2	0.15	4.9	—	10.0	—	60.0	1.0	—
	0.15	4.9	—	0	—	70.0	1.0	—
3	—	—	5.0	10.0	—	60.0	1.0	5.0
	—	—	5.0	0	—	70.0	1.0	5.0
	—	—	5.0	—	10.0	60.0	1.0	5.0

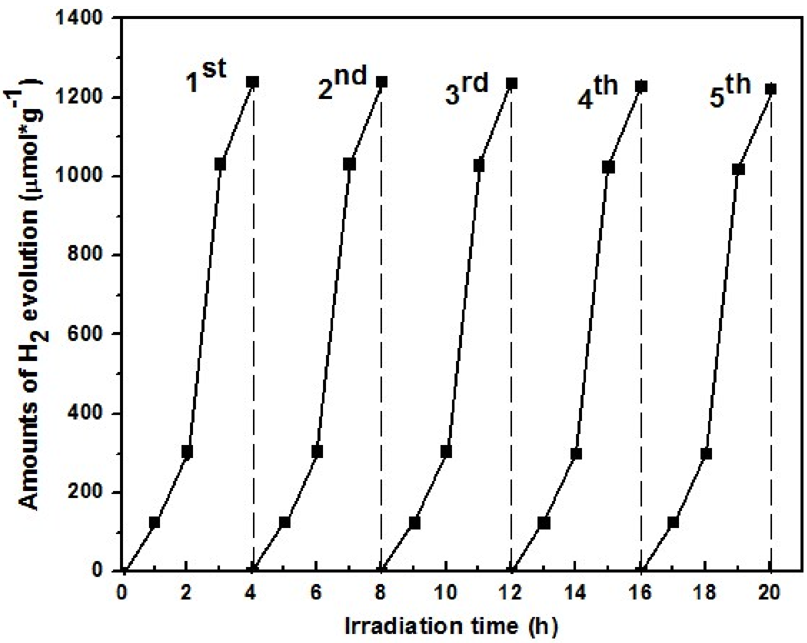


Fig. S3 Recycling experiment of 3SCN (0.005 g) for photocatalytic hydrogen production in an aqueous solution (70 mL) containing triethanolamine (10 mL) as the sacrificial agent under sunlight irradiation (irradiation time = 20 h).

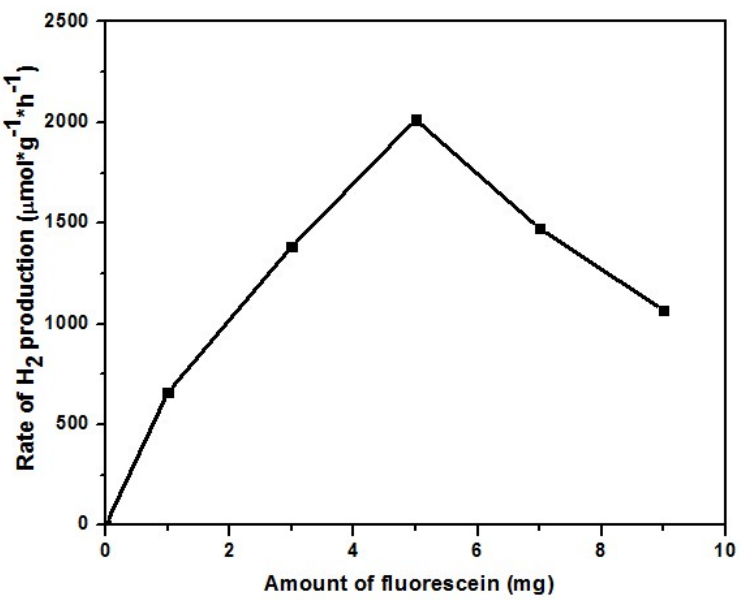


Fig. S4 Effect of amount of fluorescein on photocatalytic hydrogen evolution of 3SCN.

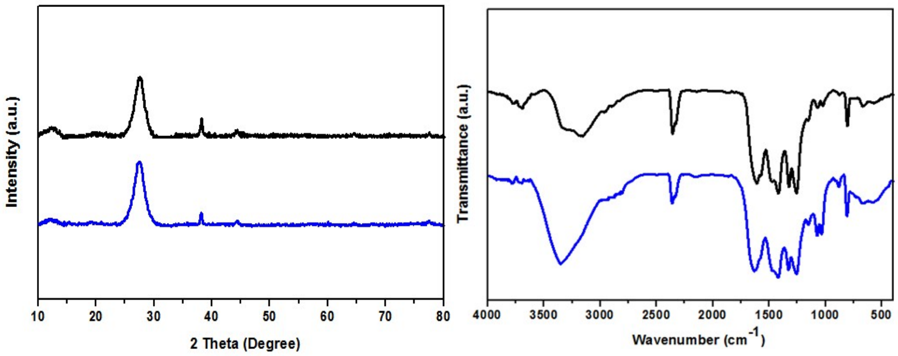


Fig. S5 Powder PXRD patterns of 3SCN (left) and FTIR spectra of 3SCN-Fluorescein (right) before (black line) and after photocatalytic reactions (blue line).

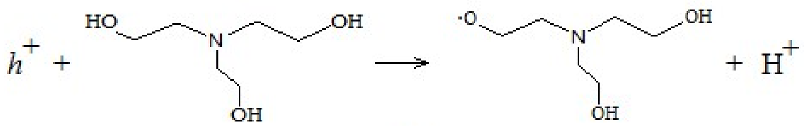
$$\text{Fluorescein} + \text{sunlight} \longrightarrow h^{+}_{HOMO} + e^{-}_{LUMO} \qquad (1)$$

$$\text{g-}C_3N_4 + \text{sunlight} \longrightarrow h^{+}_{vb} + e^{-}_{cb} \qquad (2)$$

$$e^{-}_{LUMO} \longrightarrow e^{-}_{cb} \qquad (3)$$

$$e^{-}_{cb} \longrightarrow e^{-}_{Ag} \qquad (4)$$

$$e^{-}_{Ag} + \text{sunlight} \longrightarrow e^{-}_{SPR} \qquad (5)$$



(6)

$$2\,e^{-}_{SPR} + 2\,H^{+} \longrightarrow H_2 \qquad (7)$$

Fig. S6 The specific process of H_2 production.

Both fluorescein and g-C_3N_4 can be excited by sunlight (equation (1), (2)), and then electrons from fluorescein were injected into CB of g-C_3N_4 easily with the help of SPR (equation (3)). Subsequently, the excited electrons on g-C_3N_4 were trapped by Ag nanoparticles (equation (4)). A very small amount of water can react with the h_{vb}^{+} of g-C_3N_4 to form H^+ and ·OH[1] and H^+ acquires electrons on Ag nanoparticles to generate H_2. This is why a little hydrogen evolution could be observed without sacrificial agent in the above experiments. Most of the holes are consumed by TEOA (equation (6)), promoting the separation of photogenerated electrons and producing more H^+ to participate in the following reaction. Sequentially, two H^+ obtain electrons reinforced by SPR effect (equation (5)) on the surface of Ag nanoparticles to form H_2 (equation (7)).

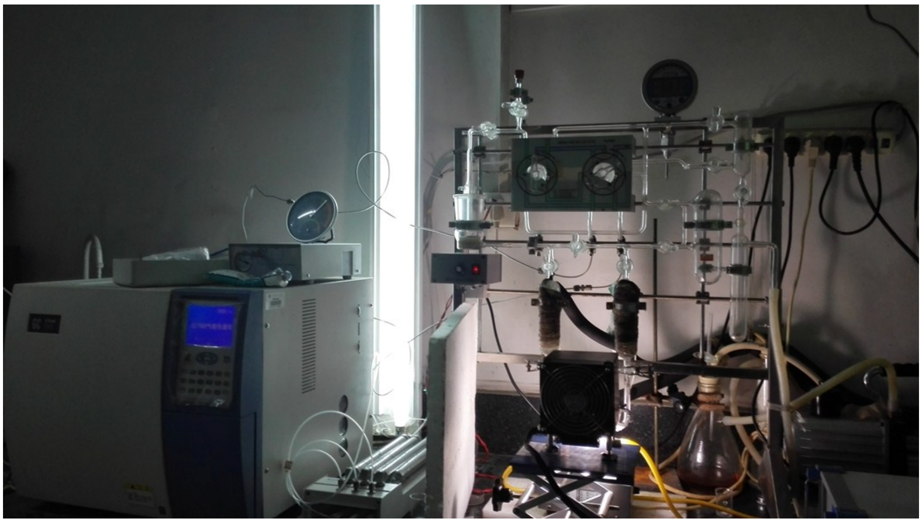


Fig. S7 Photocatalytic hydrogen production testing system.

References

1 E. Z. Liu, L. M. Kang, Y. H. Yang, T. Sun, X. Y. Hu, C. J. Zhu, H. C. Liu, Q. P. Wang, X. H. Li and J. Fan, *Nanotechnology*, 2014, **25**, 165401.