Silicon Carbide/Carbon Nitride 1D/2D Heterostructure towards Superior Visible-light-driven Hydrogen Generation from Water Splitting

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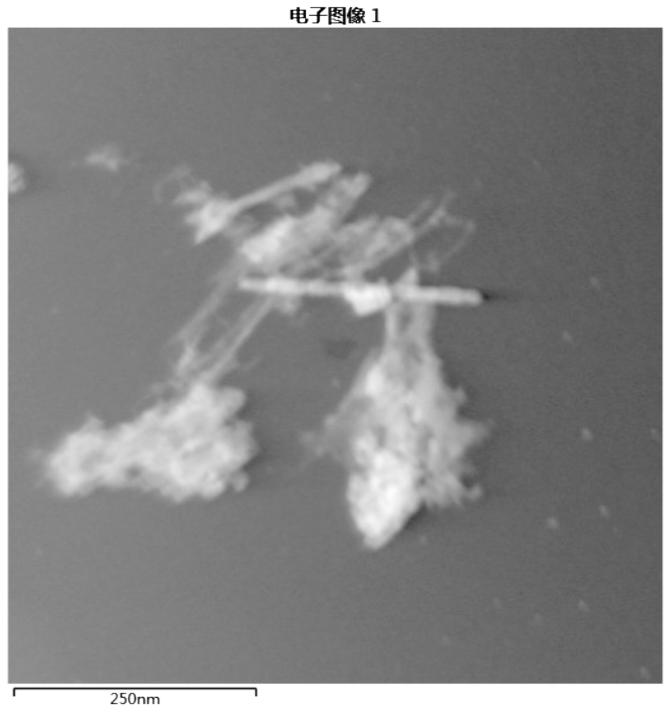

Fig. S1 STEM images of SiC/CN composite

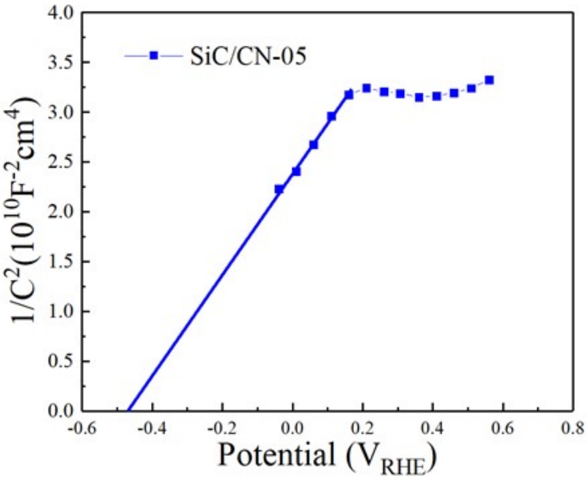

Fig. S2 Mott-Schottky (MS) plots of SiC/CN-05.

Table S1. The comparison of photocatalytic activity of this work with reported SiC/g-C_3N_4 and g-C_3N_4 based photocatalysts.

Photocatalyst	*Co-catalyst*	*Light conditions*	*Sacrificial reagent*	*Activity* (μmol g^{-1} h^{-1})
1D/2D SiC/g-C_3N_4	Pt(3wt%)	Visible light (λ≥420nm)	Triethanolamine	2250
2D/0D g-C_3N_4/SiC[1]	Pt(1wt%)	Visible light (λ≥420nm)	Triethanolamine	182
2D/0D g-C_3N_4-SiC-Pt[2]	Pt(1wt%)	Visible light (λ≥420nm)	Triethanolamine	595.3
(SiC/C)/g- C_3N_4[3]	Pt(1wt%)	Visible light (λ≥420nm)	Triethanolamine	200.2
B-doped C_3N_4/ZnO[4]	Pt(2wt%)	Visible light (λ≥420nm)	Triethanolamine	357
C@TiO_{2-x}/CN NS[5]	Pt(3wt%)	Visible light (λ≥420nm)	Triethanolamine	1830.9
MoO_{3-x}/PCN[6]	Pt(3wt%)	Visible light (λ≥420nm)	Triethanolamine	2336.15
Pi-Ho@$C_{3-x}N_4$[7]	Pt(3wt%)	Visible light (λ≥400nm)	Triethanolamine	6320

S2 The apparent quantum yield (AQY) calculation

$$N_{H_2} = 2 \times 6.02 \times 10^{23} \times nH_2 \qquad \text{S1}$$

$$N_{p,\lambda} = \frac{pst\lambda}{hc} \qquad \text{S2}$$

in which p is the light intensity, s is the irradiation area, t is the H_2 production time, λ is the wavelength of incident light, h is Planck's constant and the value is 6.626×10^{-34}, and c the speed of light. The detailed parameters were provided in Table S3.

Table S2. The calculated AQY at different wavelengths

λ (nm)	S (cm^2)	PS (mW)	t (s)	C (m/s)	H_2 (μmol h^{-1})	AQY (%)
380	10.17	15.25	3600	3×10^8	7.32	8.4
420	10.17	22.37	3600	3×10^8	4.34	3.0
450	10.17	26.64	3600	3×10^8	2.28	1.3
500	10.17	30.91	3600	3×10^8	0	0
600	10.17	32.37	3600	3×10^8	0	0

λ=380 nm：

$$N_{p,\lambda} = \frac{PSt\lambda}{hc} = \frac{15.25 \times 10^{-3} \times 3600 \times 380 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}} = 1.049 \times 10^{20}$$

$$AQY = \frac{2 \times 6.02 \times 10^{23} \times 7.32 \times 10^{-6}}{1.049 \times 10^{20}} \times 100\% = 8.4\%$$

λ=420 nm：

$$N_{p,\lambda} = \frac{PSt\lambda}{hc} = \frac{22.37 \times 10^{-3} \times 3600 \times 420 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}} = 1.701 \times 10^{20}$$

$$AQY = \frac{2 \times 6.02 \times 10^{23} \times 4.32 \times 10^{-6}}{1.701 \times 10^{20}} \times 100\% = 3.0\%$$

λ=450 nm：

$$N_{p,\lambda} = \frac{PSt\lambda}{hc} = \frac{26.64 \times 10^{-3} \times 3600 \times 450 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}} = 2.17 \times 10^{20}$$

$$AQY = \frac{2 \times 6.02 \times 10^{23} \times 2.28 \times 10^{-6}}{2.17 \times 10^{20}} \times 100\% = 1.3\%$$

λ=500 nm：

$$N_{p,\lambda} = \frac{PSt\lambda}{hc} = \frac{30.91 \times 10^{-3} \times 3600 \times 500 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}} = 2.79 \times 10^{20}$$

$$AQY = \frac{2 \times 6.02 \times 10^{23} \times 0 \times 10^{-6}}{2.79 \times 10^{20}} \times 100\% = 0$$

λ=600 nm：

$$N_{p,\lambda} = \frac{PSt\lambda}{hc} = \frac{32.37 \times 10^{-3} \times 3600 \times 600 \times 10^{-9}}{6.626 \times 10^{-34} \times 3 \times 10^{8}} = 3.51 \times 10^{20}$$

$$AQY = \frac{2 \times 6.02 \times 10^{23} \times 0 \times 10^{-6}}{3.51 \times 10^{20}} \times 100\% = 0$$

Table S3. Band gaps and absorption edges of all samples.

Samples	Band gap energy/eV	Absorption edge/nm
CN	2.68	440
SiC/CN-01	2.52	456
SiC/CN-05	2.48	462
SiC/CN-10	2.49	459
SiC	2.64	544

Table S4. Resistance values of various samples as obtained from EIS measurements.

Catalysts	R_1 / Ω	R_2 / Ω
CN	40.12	3800
SiC/CN-01	45.05	580
SiC/CN-05	42.07	433.0
SiC/CN-10	57.81	503.7

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