

Supplementary Material

Emerging Non-metal Cocatalysts CNT on g-C₃N₄ for Enhancing the Treatment of Waste Drilling Fluid Filtrate.

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1 Pre-prepared reagents :

1) Slowly add 100 mL of sulfuric acid to 900 mL of water along the inner wall of a beaker, stir thoroughly, and allow the solution to cool for later use.

2) Add 5.0 g of silver sulfate to 500 mL of the sulfuric acid prepared above, let it stand for 1–2 days, and stir until dissolved.

3) Gradually add 48.0 g of mercuric sulfate, in portions, to 200 mL of the sulfuric acid solution prepared above, stirring until dissolved.

4) (Potassium Dichromate Standard Solution: $c(1/6 \text{ K}_2\text{Cr}_2\text{O}_7) = 0.500 \text{ mol/L}$.)

Dry the potassium dichromate at $120^\circ\text{C} \pm 2^\circ\text{C}$ to a constant weight. Weigh 24.5154 g of potassium dichromate into a beaker, add 600 mL of water, and slowly add 100 mL of the sulfuric acid prepared above while stirring until dissolved. After cooling, transfer the solution to a 1000 mL volumetric flask and dilute to the mark with water, then mix well.

5) (Potassium Dichromate Standard Solution: $c(1/6 \text{ K}_2\text{Cr}_2\text{O}_7) = 0.160 \text{ mol/L}$.)

Dry the potassium dichromate at $120^\circ\text{C} \pm 2^\circ\text{C}$ to a constant weight. Weigh 7.8449 g of potassium dichromate into a beaker, add 600 mL of water, and slowly add 100 mL of sulfuric acid while stirring until dissolved. After cooling, transfer the solution to a 1000 mL volumetric flask and dilute to the mark with water, then mix well.

6) Potassium Dichromate Standard Solution: $C(1/6 \text{ K}_2\text{Cr}_2\text{O}_7) = 0.120 \text{ mol/L}$.

Dry the potassium dichromate at $120^\circ\text{C} \pm 2^\circ\text{C}$ to a constant weight. Weigh 5.8837 g of potassium dichromate into a beaker, add 600 mL of water, and slowly add 100 mL of sulfuric acid while stirring until dissolved. After cooling, transfer the solution to a 1000 mL volumetric flask and dilute to the mark with water, then mix well.

2 Preparation of abandoned drilling hydraulic filtrate

The waste drilling fluid is sourced from the Chang-Qing oil and gas field in China (Well No. Long-dong 27-13), with the organic compounds in the waste drilling hydraulic filtrate primarily consisting of sulfonated phenolic resins.

3 Photoelectrochemical Performance Test

The photoelectrochemical performance was evaluated using a three-electrode electrochemical workstation, where a platinum electrode served as the counter electrode, a calomel electrode was

used as the reference electrode, and the sample acted as the working electrode. The electrolyte consisted of a 0.2 mol/L Na₂SO₄ aqueous solution. The working electrode was prepared as follows: 10 mg of the sample was dispersed in 1 mL of anhydrous ethanol via ultrasonic treatment, and the resulting suspension was applied onto fluorine-doped tin oxide (FTO) conductive glass (20 mm x 10 mm x 2 mm) to form a uniform coating of approximately 50 μm thickness. After drying, the FTO glass was sealed with epoxy resin. Open circuit voltage and electrochemical impedance spectroscopy (EIS) measurements were performed within a frequency range of 0.1 Hz to 1 x 10⁶ Hz, with an AC amplitude of 0.2 V. The transient photocurrent was measured under irradiation from a 300 W xenon lamp for 500 seconds, with a 100-second interval between measurements.

4 Tables

Table S1. Specific surface area and pore structure characteristic data.

Sample	Surface Area (m ² /g)	Pore Volume (cm ³ /g)	Pore Size (nm)
g-C ₃ N ₄	39.453	0.171	3.385
CNT	159.416	1.407	20.979
g-C ₃ N ₄ /CNT	42.191	0.263	12.788

Table S2. Values of elements in equivalent circuit resulted from fitting the EIS data in Figure 6(C).

Sample	R _s (Ω cm ⁻²)	R _{ct} (Ω cm ⁻²)	CPE (F cm ⁻²)
g-C ₃ N ₄	45.12	8795974	1.35126E-5
g-C ₃ N ₄ /3.0 wt% CNT	47.25	1478973	1.68924E-5
g-C ₃ N ₄ /6.0 wt% CNT	48.21	1387568	1.86345E-5
g-C ₃ N ₄ /9.0 wt% CNT	46.57	1453546	2.15678E-5

Table S3. The fitting parameters of TRPL decay curves in Figure 6(F).

Sample	A_1	τ_1 (ns)	A_2	τ_2 (ns)	τ_{avg} (ns)
g-C ₃ N ₄	113.24759	1.98349	0.59925	8.27491	2.12
g-C ₃ N ₄ /3.0 wt% CNT	103.82879	1.99331	0.91144	7.16543	2.15
g-C ₃ N ₄ /6.0 wt% CNT	108.66965	2.0595	0.94036	7.54381	2.22
g-C ₃ N ₄ /9.0 wt% CNT	105.20413	1.95723	1.31081	6.79644	2.16

Comment : $\tau_{avg} = (A_1\tau_1^2 + A_2\tau_2^2) / (A_1\tau_1 + A_2\tau_2)$

Table S4. The percentage content of C, N, and O elements in each sample was tested by XPS.

Sample	C 1s (%)	N 1s (%)	O 1s (%)
g-C ₃ N ₄	43.12	54.58	2.29
CNT	97.46	0.58	1.96
g-C ₃ N ₄ /CNT	51.93	44.74	3.34

5 Figures

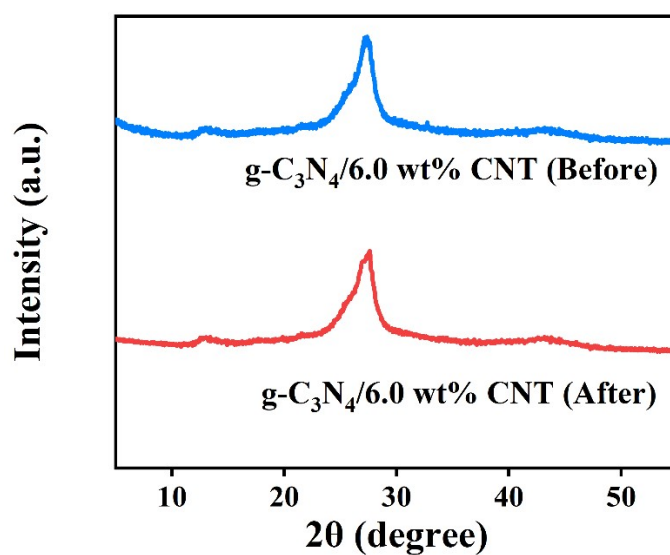


Figure S1. The XRD spectra of catalysts used before and after

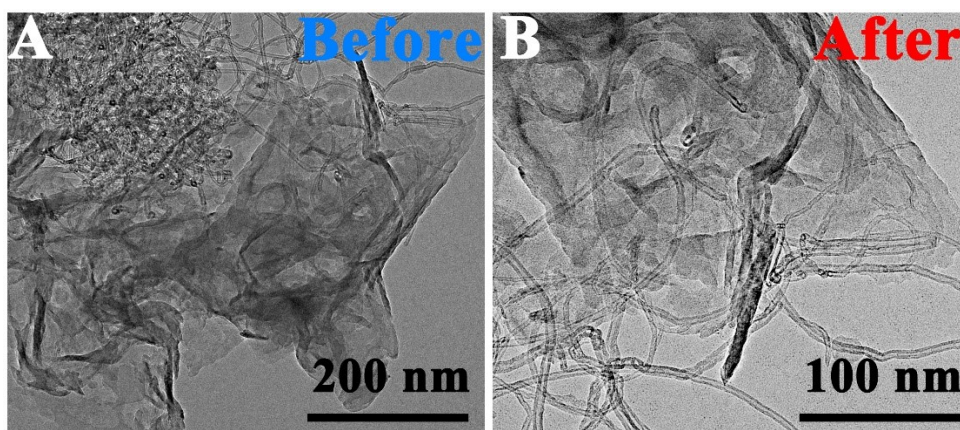


Figure S2. The TEM images of the catalyst being used before and after

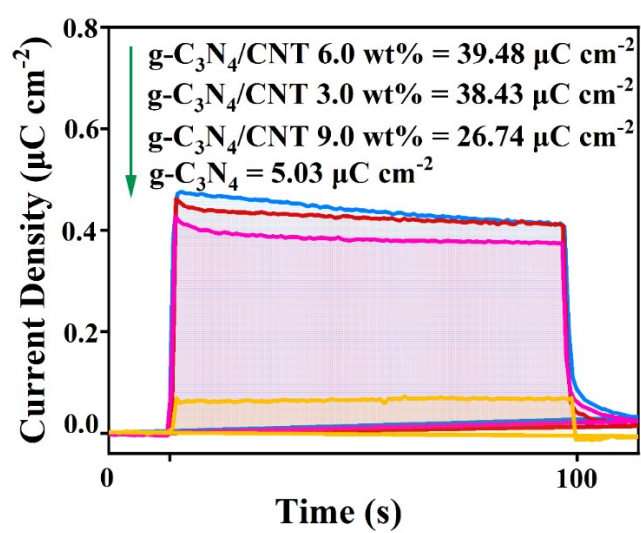


Figure S3. 0-100s transient photocurrent curve area integral plot