



Supplementary Materials

The photocatalytic conversion of carbon dioxide to fuels using titanium dioxide nanosheets/graphene oxide heterostructure as photocatalyst

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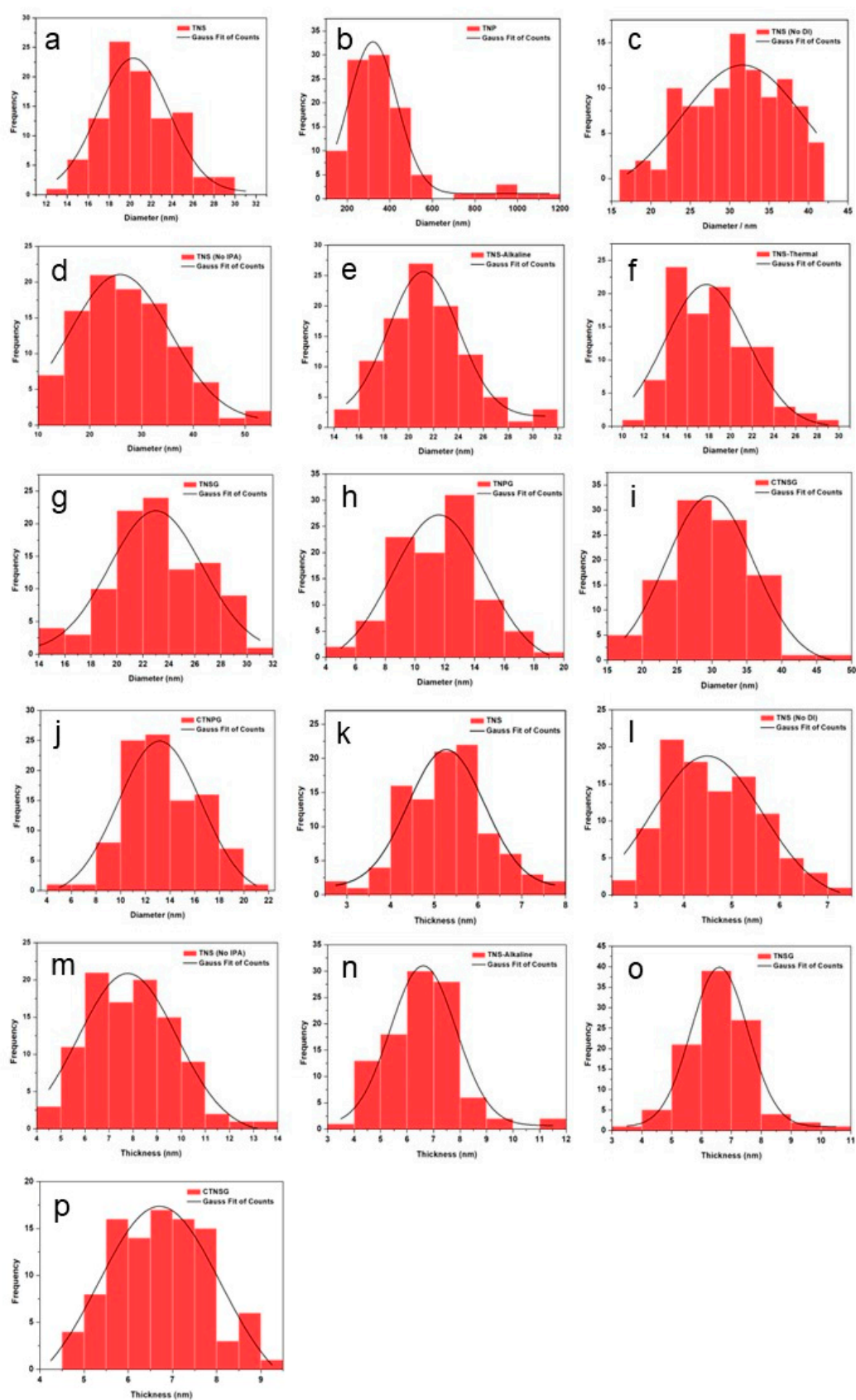


Figure S1. Particle size (a–j) and thickness (k–p) distribution histograms of the TNS, TNP and composites.

Table S1. Dimensions of the photocatalysts.

Catalyst	Width (nm)	Thickness (nm)
TNS	20.3 ± 0.4	5.3 ± 0.1
TNS (HF+IPA)	31.6 ± 0.8	4.5 ± 0.1
TNS (DI+HF)	25.8 ± 0.6	7.8 ± 0.2
TNS-Alkaline	21.2 ± 0.2	6.6 ± 0.1
TNS-Thermal	17.8 ± 0.6	-
TNP	320.6 ± 5.5	-
TNSG	23.0 ± 0.5	6.6 ± 0.1
TNPG	11.6 ± 0.5	-
CTNSG	29.7 ± 0.4	6.7 ± 0.1
CTNPG	13.2 ± 0.5	-

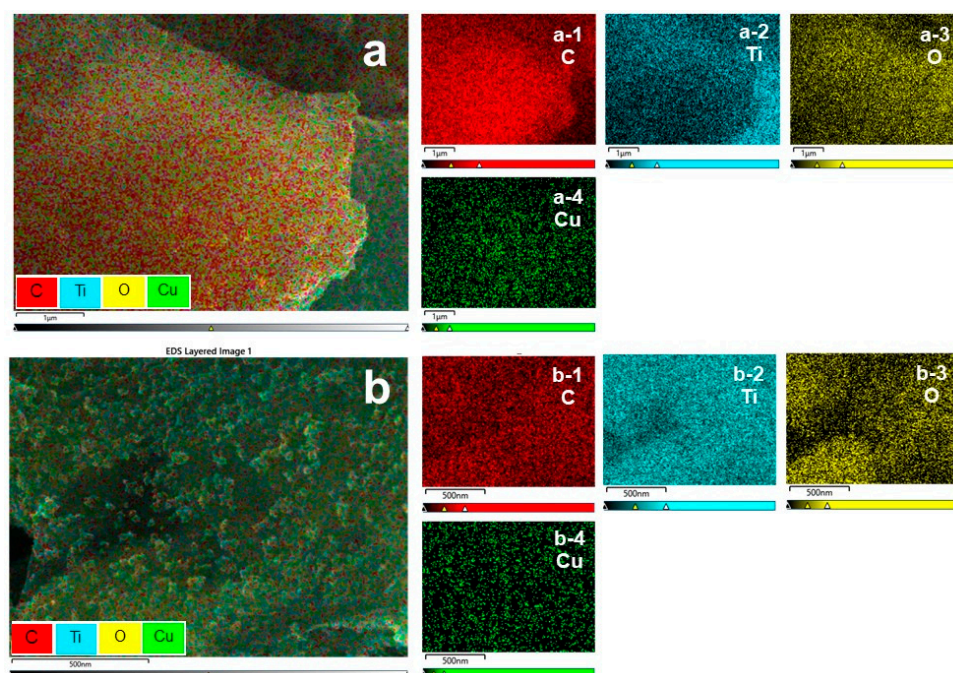


Figure S2. EDS mapping of atomic composition of the CTNSG (a) and CTNPG (b).

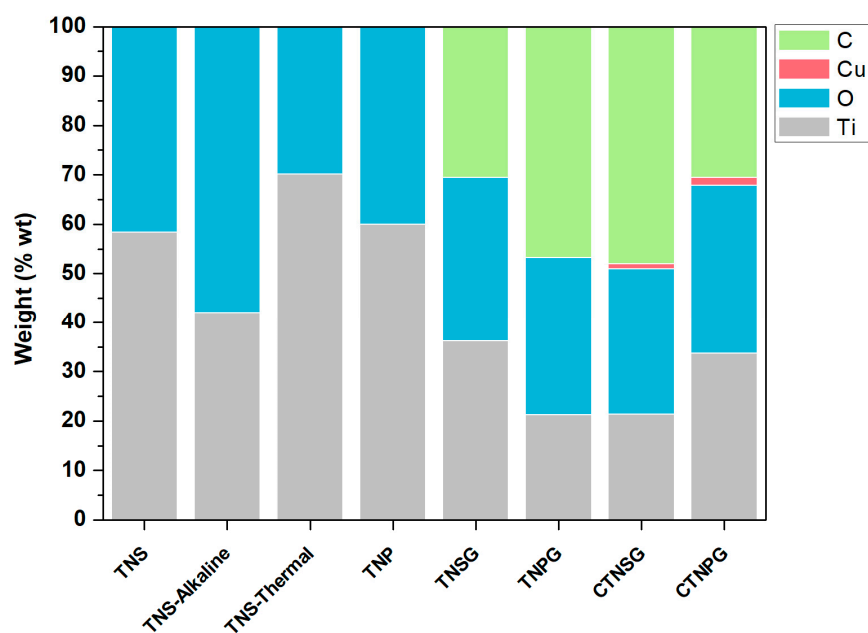


Figure S3. Quantitative EDS analysis of TNS, TNP and composites.

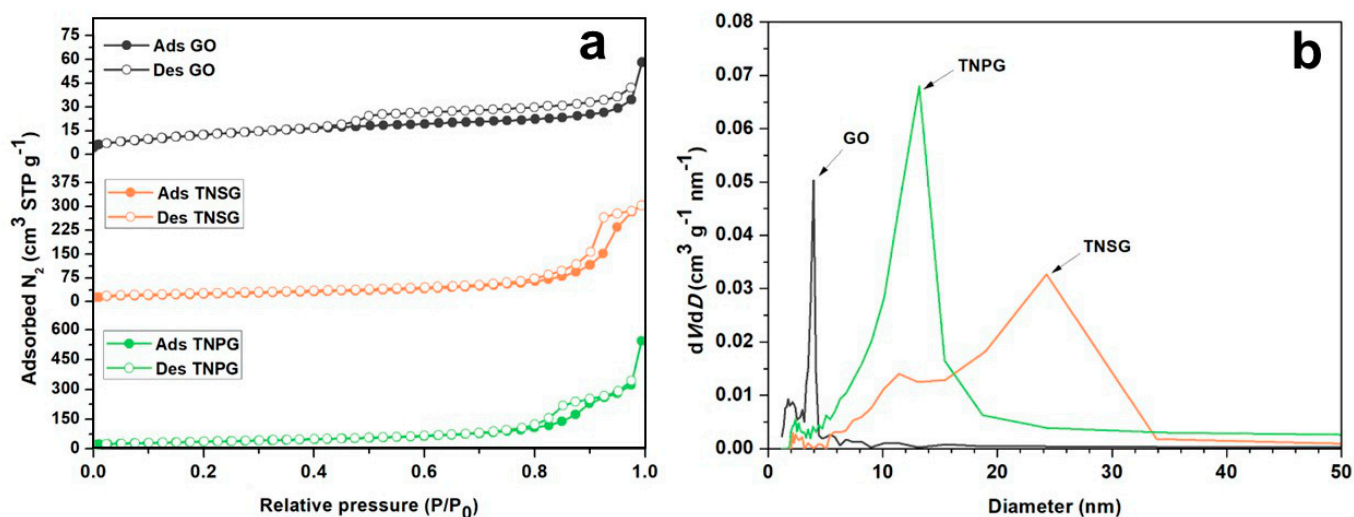


Figure S4. The N₂ adsorption–desorption isotherms (a) and the pore–size distribution curves (b) of the GO, TNSG and TNPG.

Table S2. Physicochemical and optical properties of the samples.

Catalyst	S_{BET} ($\text{m}^2 \text{g}^{-1}$)	Average mesopore size 1 (nm)	Average mesopore size 2 (nm)	Band gap energy (eV)
GO	50.2	3.9	0	2.22
TNS	110.4	10.1	0	3.07
TNP	138.2	13.2	0	3.38
TNSG	86.4	11.4	24.29	2.98
TNPG	133.4	13.2	0	3.31
CTNSG	81.3	11.4	33.86	2.66
CTNPG	139.19	13.1	0	3.17

Table S3. CO₂ photoreduction products obtained from various operations.

Catalyst	Condition ¹		Production rate ($\mu\text{mol h}^{-1}\text{g}_{\text{cat}}^{-1}$)			Total carbon consumption ($\mu\text{mol g}_{\text{cat}}^{-1}$)	%PQE ($\times 10^{-2}$)
	Light source	%RH	Methane	Methanol	Acetone		
P25	160 Watts	100	0.95	0	0.28	18.57	0.71
TNS	160 Watts	100	4.30	0	0.42	27.75	0.24
TNS (HF+IPA)	160 Watts	100	0.51	0	0.12	4.35	0.35
TNS (DI+HF)	160 Watts	100	1.85	0	0.56	17.65	1.39
TNS-Alkaline	160 Watts	100	4.65	0	0.48	30.45	2.63
TNS-Thermal	160 Watts	100	2.34	0	0.39	13.50	1.46
TNP	160 Watts	100	2.03	0	0.40	21.45	0.13
TNSG	160 Watts	100	2.81	0	0.69	24.40	0.20
TNPG	160 Watts	100	2.28	0	0.72	22.20	0.17
CTNSG	160 Watts	100	12.09	0	0.74	71.65	0.64
CTNPG	160 Watts	100	4.58	0	1.33	43.15	0.34
CTNSG	160 Watts	0	2.50	0	0.21	3.11	0.53
CTNSG	160 Watts	20	4.34	0	0.35	5.39	2.45
CTNSG	160 Watts	40	5.12	0	0.32	6.08	2.33
CTNSG	160 Watts	60	6.45	0	0.34	7.47	3.34
CTNSG	160 Watts	80	9.16	0	0.42	10.43	4.69
CTNSG	No	100	0	0	0	0	0.00
CTNSG	16 Watts	100	6.84	1.23	3.07	86.40	47.15
CTNSG	250 Watts	100	14.09	0	0.56	78.85	0.64
CTNSG	16 Watts / 160 Watts	100	6.35	1.16	2.91	81.2	44.83

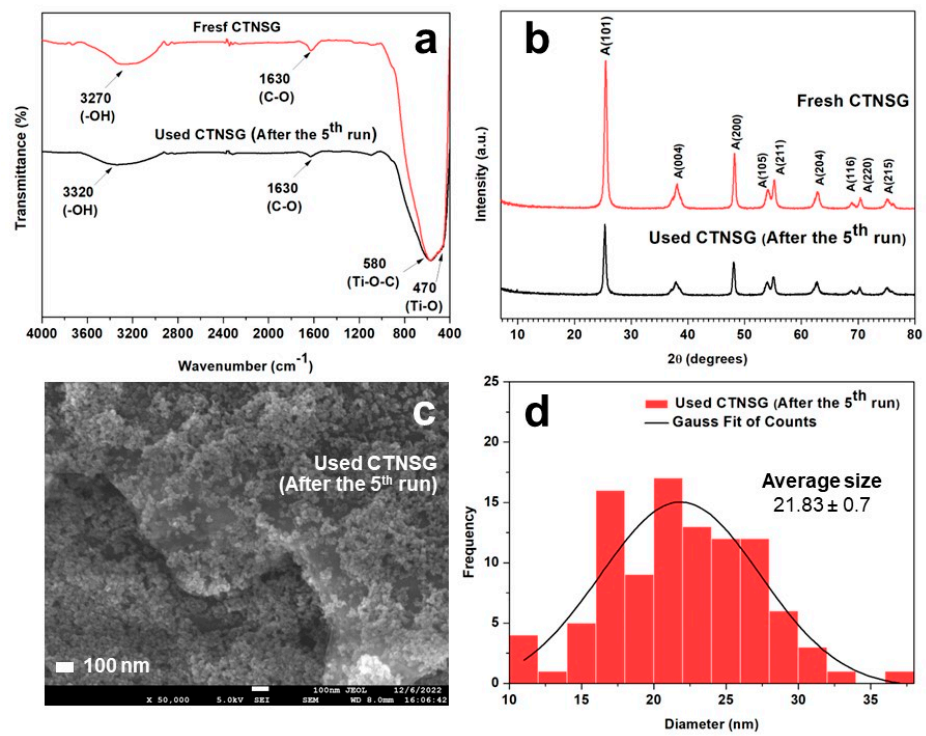


Figure S5. The FT-IR spectra (a), XRD spectra (b), SEM image (c) and particle size distribution (d) of the virgin and reused CTNSG.