Electronic supplementary information (ESI)

A novel molecular expanded covalent triazine framework heterojunctions with significantly enhanced molecular oxygen activation and photocatalysis performance under visible light

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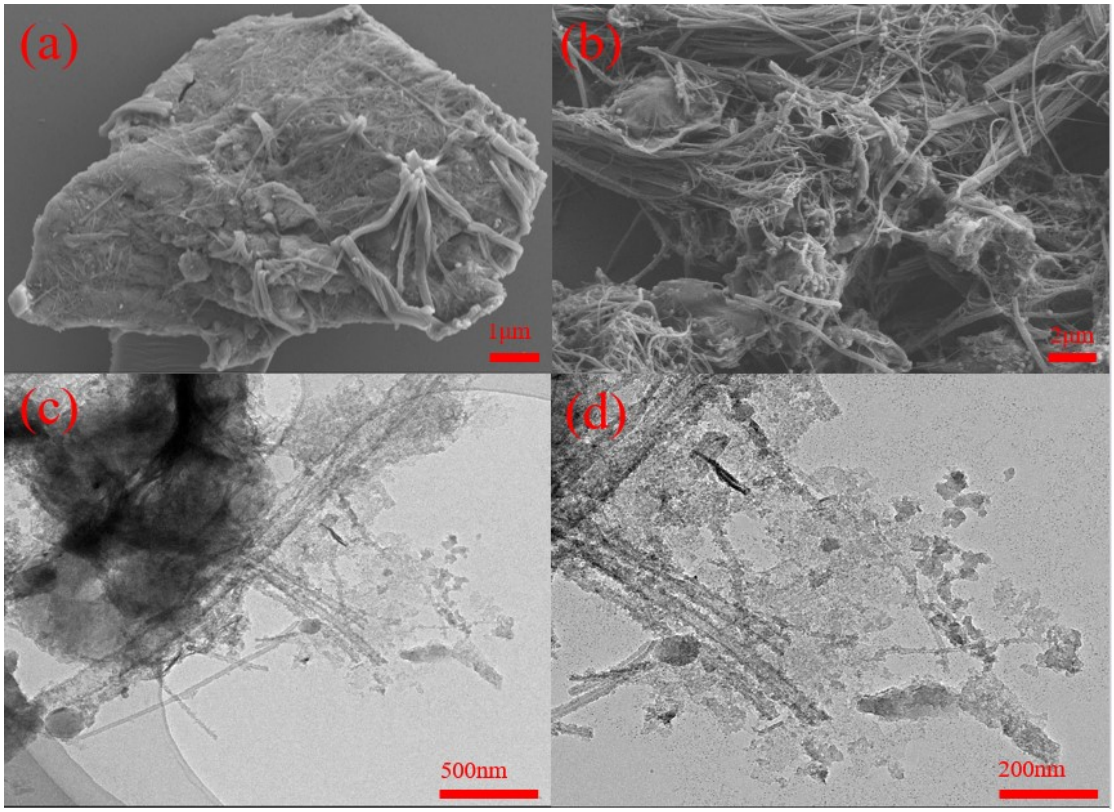
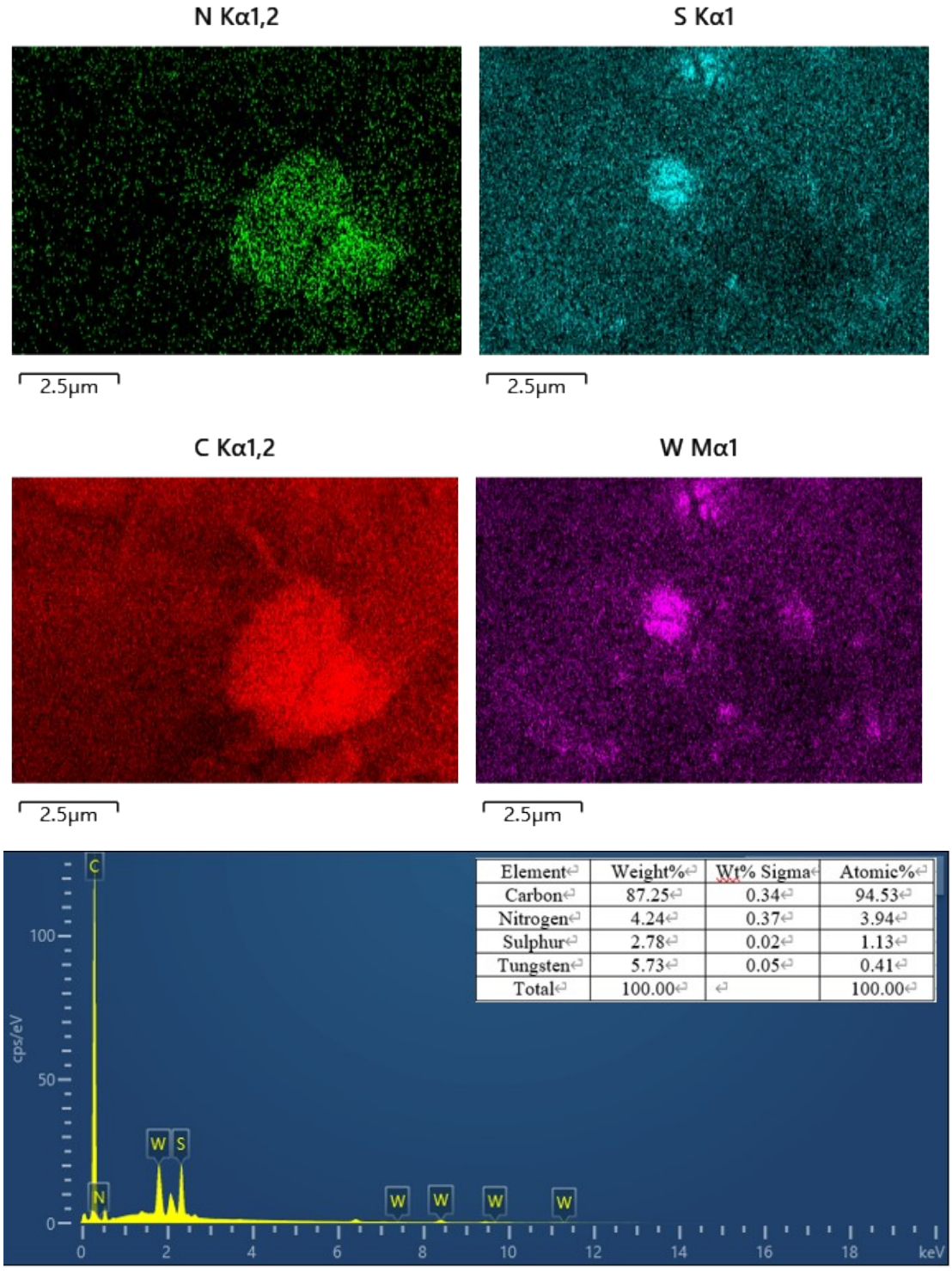


Fig.S1 (a) SEM image of CTF-1 (b) SEM image of CTF-1-G (c) and (d) TEM image of CTF-1-G in size of 200 nm and 500 nm, respectively.



Element	Weight%	Wt% Sigma	Atomic%
Carbon	87.25	0.34	94.53
Nitrogen	4.24	0.37	3.94
Sulphur	2.78	0.02	1.13
Tungsten	5.73	0.05	0.41
Total	100.00		100.00

Fig.S2 N, S, C and W STEM EDX mapping of C-GW_{15}.

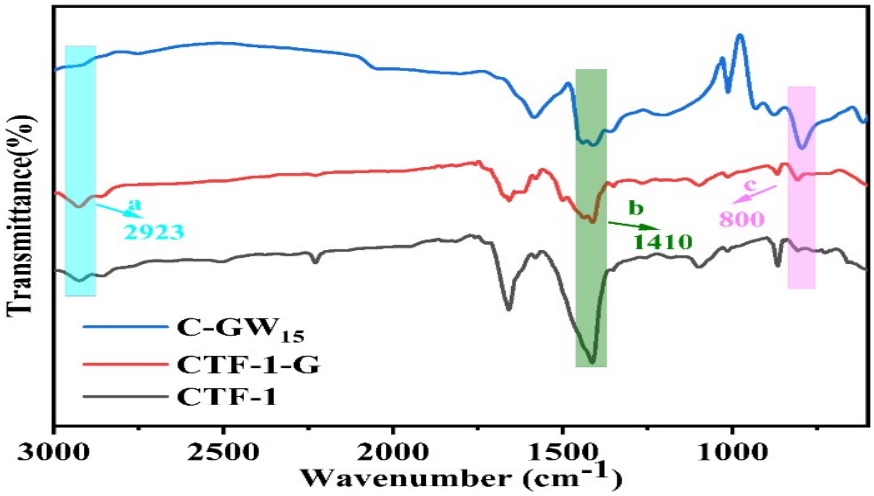


Fig.S3 IR spectra of CTF-1, C-F-1-G and heterojunction C-GW_{15}

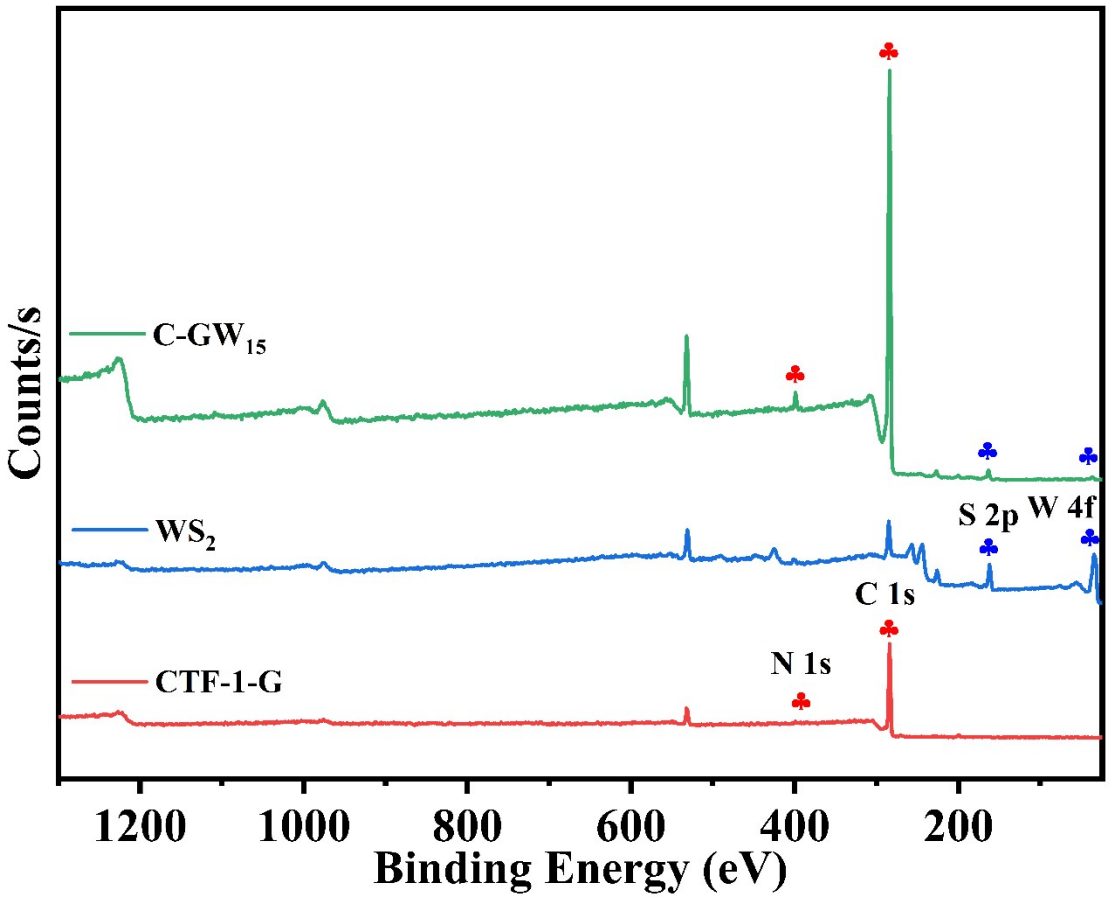


Fig.S4 XPS spectra of CTF-1-G, WS_2 and C-GW_{15}.

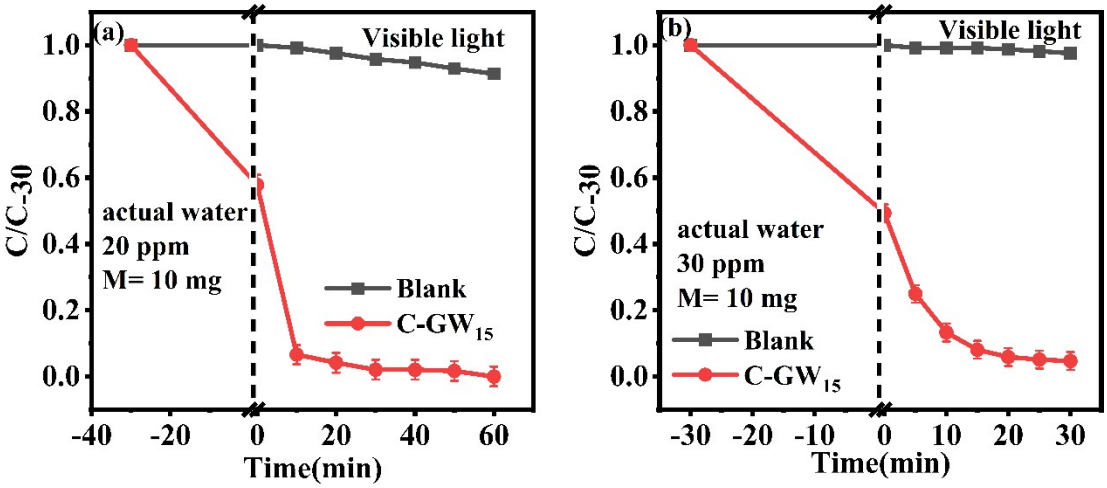


Fig. S5 (a) Photocatalytic degradation curves of TC over C-GW$_{15}$; (b) Photocatalytic degradation curves of RHB over C-GW$_{15}$.

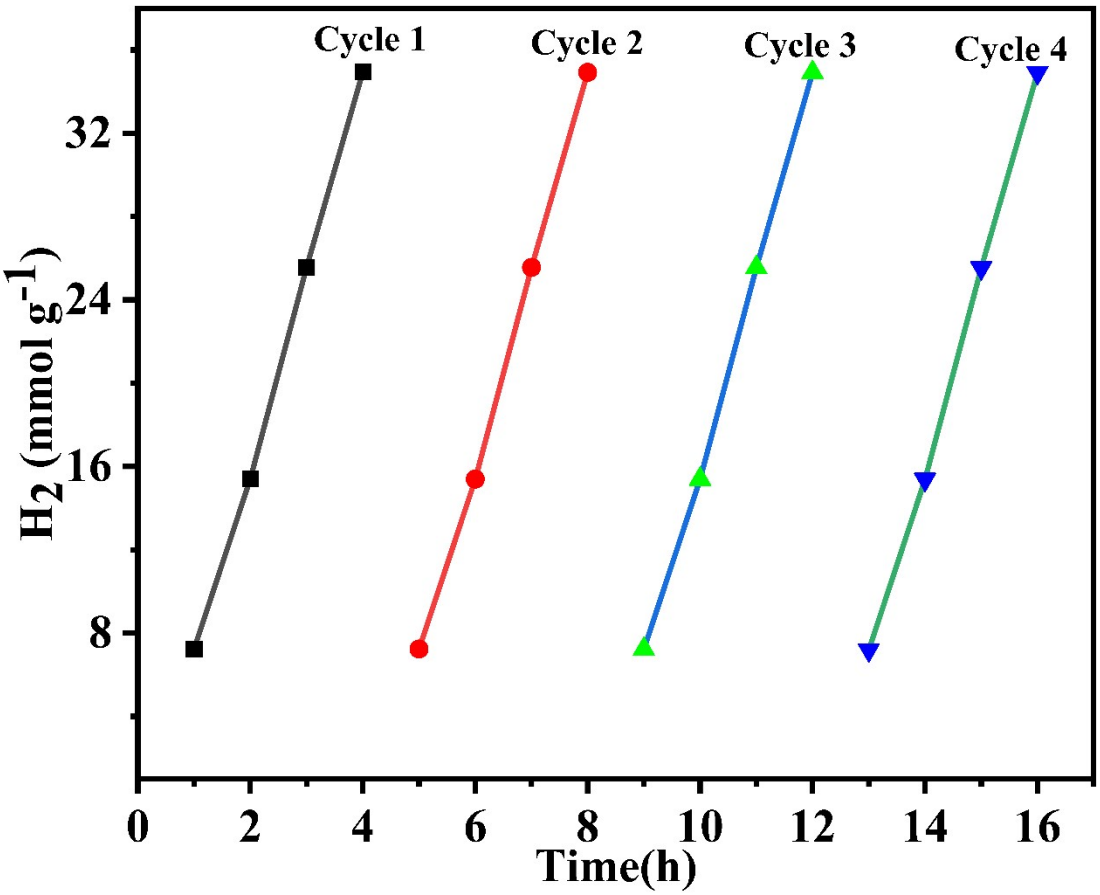


Fig. S6 H_2 produced by C-GW$_{15}$ for 4 consecutive cycles in every 4h time interval.

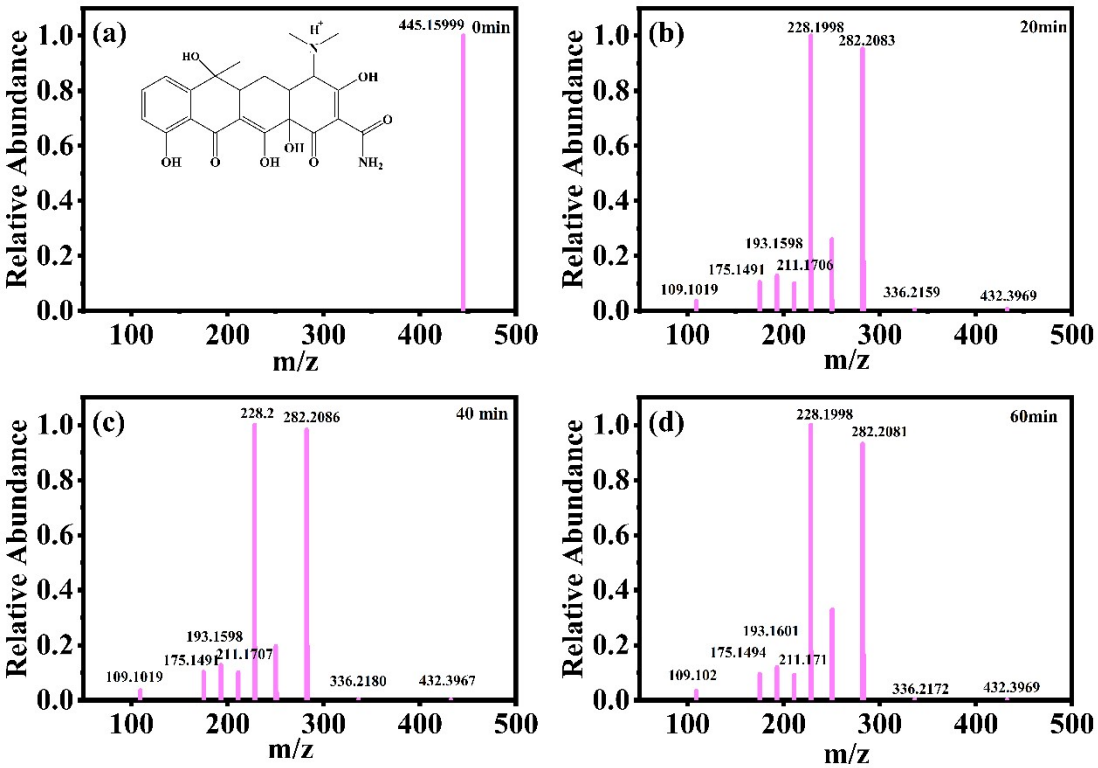


Fig.S7 Variations in the relative intensity of intermediate products of TC with different reaction time, as obtained in the LC-MS spectra.

Table.S1 Comparison of WS_2 Based heterojunction for Photocatalytic RhB Degradation.

Catalyst / mg	*V (mL) / C_{-30} ($mg \cdot L^{-1}$)*	*Light source*	*Time (min)*	*Result (%)*	*TOF*	*Ref*
CTF-1-G/WS_2/10	50/30	Visible light	35	98%	4.2	This work
WS2Q.Dots/ BiOCl/20	100/20	Visible light	20	80.1%	4.005	[1]
WS_2/AgI /50	150/10	Visible light	30	91.2%	0.912	[2]

Table S2 Comparison of the photocatalytic H_2 evolution rates over different photocatalysts.

Photocatalysts	*Irrigation*	*Sacrificial agents*	*Activity $\mu mol \cdot g^{-1}h^{-1}$*	*Ref*

CTF-1-G/WS_2	Visible light	Na_2SO_3 and Na_2S	8735.65	This work
WS_2/g-C_3N_4	Sun light	TEOA	154	[3]
WS_2/$ZnIn_2S_4$	Visible light	Na_2SO_3 and Na_2S	199.1	[4]
Eh-WS_2	Sunlight	Lactic acid	113.56	[5]
FL-WS_2/$CdLa_2S_4$	Visible light	Na_2S and Na_2SO_3	3330	[6]

Reference

[1] P. Xiao, J. Lou, H. Zhang, W. Song, X.-L. Wu, H. Lin, J. Chen, S. Liu, X. Wang, Enhanced visible-light-driven photocatalysis from WS2 quantum dots coupled to BiOCl nanosheets: synergistic effect and mechanism insight, Catalysis Science & Technology, 8 (2018) 201-209.

[2] X.F. Wu, H. Li, Y. Zhang, J.R. Zhang, J.Z. Su, Y.M. Feng, W.G. Zhang, L.S. Sun, X.G. Sun, Synthesis of AgI/WS2 hybrids as a novel photocatalyst with efficient degradation of rhodamine B, Micro & Nano Letters, 14 (2019) 173-177.

[3] Y. Zhou, X. Ye, D. Lin, One-pot synthesis of non-noble metal WS2/g-C3N4 photocatalysts with enhanced photocatalytic hydrogen production, International Journal of Hydrogen Energy, 44 (2019) 14927-14937.

[4] J. Zhou, D. Chen, L. Bai, L. Qin, X. Sun, Y. Huang, Decoration of WS2 as an effective noble-metal free cocatalyst on ZnIn2S4 for enhanced visible light photocatalytic hydrogen evolution, International Journal of Hydrogen Energy, 43 (2018) 18261-18269.

[5] G. Koyyada, S.V. Prabhakar Vattikuti, S. Shome, J. Shim, V. Chitturi, J.H. Jung, Enhanced solar light-driven photocatalytic degradation of pollutants and hydrogen evolution over exfoliated hexagonal WS2 platelets, Materials Research Bulletin, 109 (2019) 246-254.

[6] X. Liu, X. Chen, S. Wang, L. Yan, J. Yan, H. Guo, F. Yang, J. Lin, Promoting the photocatalytic H2 evolution activity of CdLa2S4 nanocrystalline using few-layered WS2 nanosheet as a co-catalyst, International Journal of Hydrogen Energy, 47 (2022) 2327-2337.