Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Direct Z-scheme WO_3/Covalent organic frameworks (COFs) heterostructure for enhanced photocatalytic hydrogen peroxide production in water

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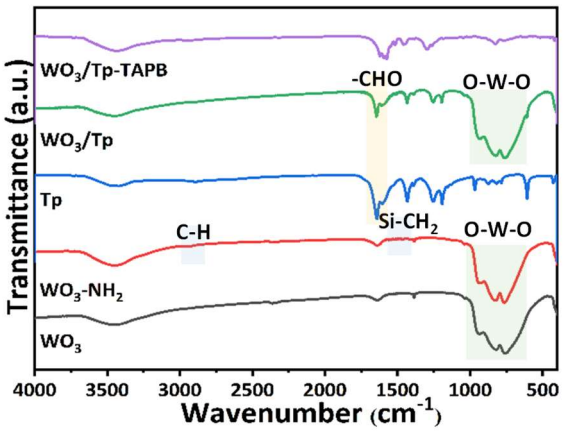

Fig. S1. FT-IR survey spectra of WO_3, WO_3-NH_2, Tp, WO_3/Tp and WO_3/Tp-TAPB

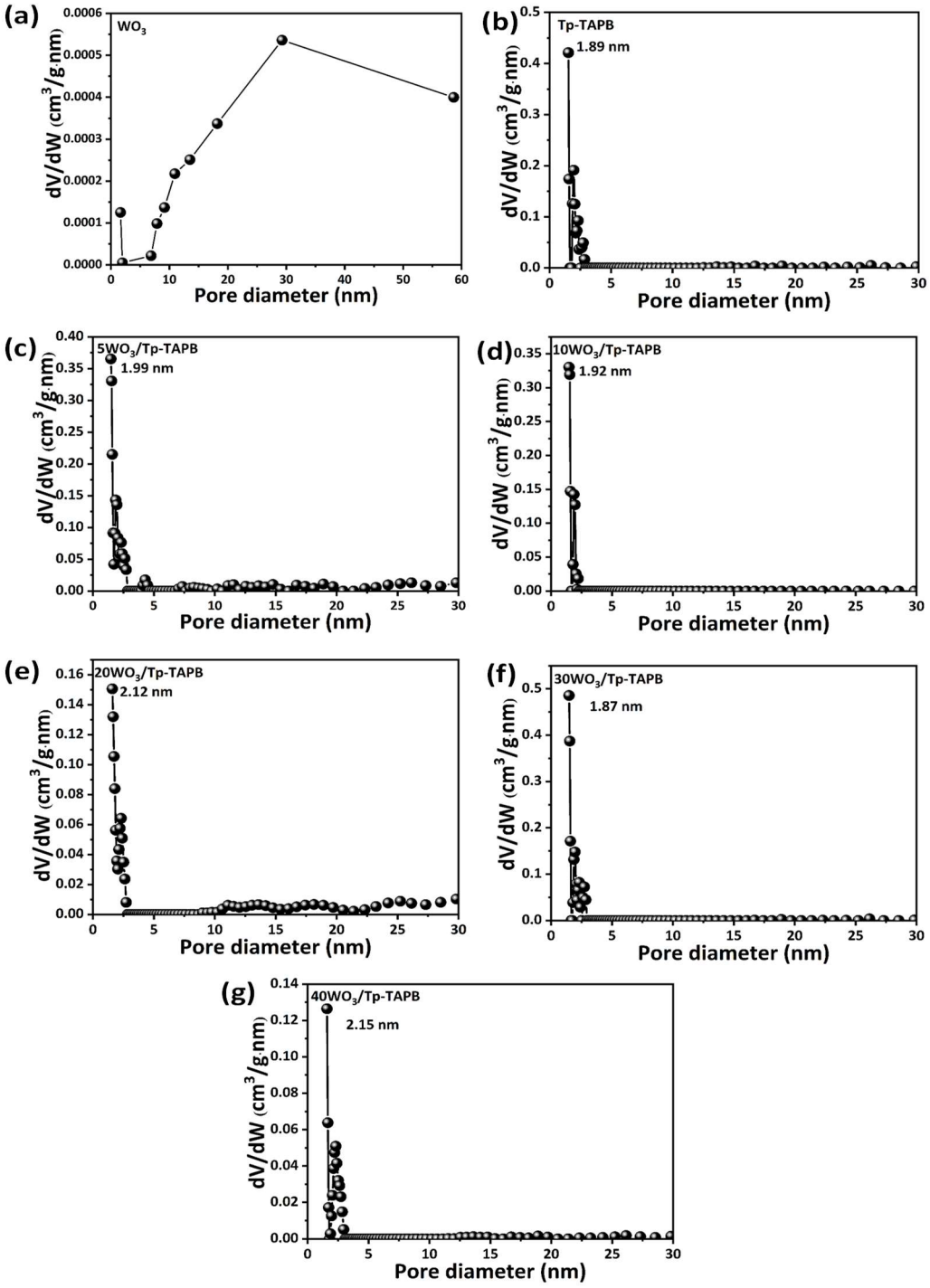

Fig. S2. (a) Pore size distributions estimated by BJH of WO_3; (b) Pore size distributions estimated by NLDFT of Tp-TAPB; (c) Pore size distributions estimated by NLDFT of $5WO_3$/Tp-TAPB; (d) Pore size distributions estimated by NLDFT of $10WO_3$/Tp-TAPB; (e) Pore size distributions estimated by NLDFT of $20WO_3$/Tp-TAPB; (f) Pore size distributions estimated by NLDFT of $30WO_3$/Tp-TAPB; (g) Pore size distributions estimated by NLDFT of $40WO_3$/Tp-TAPB

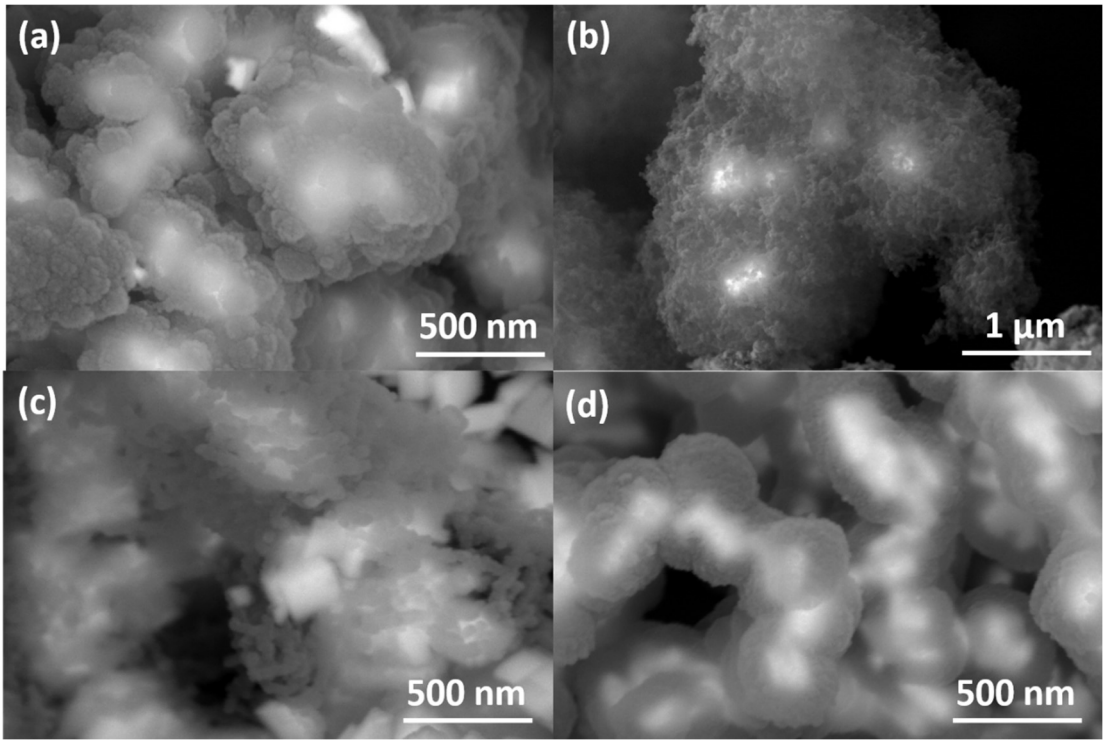

Fig. S3. SEM and image of (a) 5WO_3/Tp-TAPB; (b) 10WO_3/Tp-TAPB; (c) 30WO_3/Tp-TAPB; (d) 40WO_3/Tp-TAPB

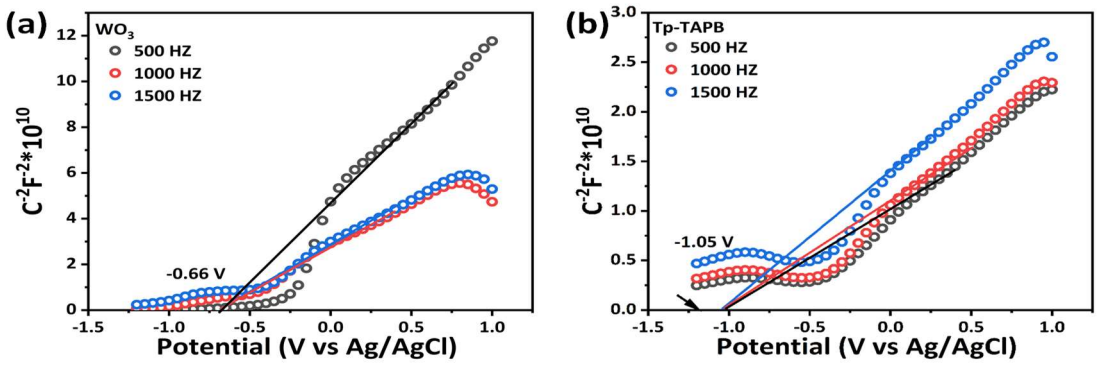

Fig. S4. (a) Mott-Schottky plots of WO_3, (b) Mott-Schottky plots of Tp-TAPB

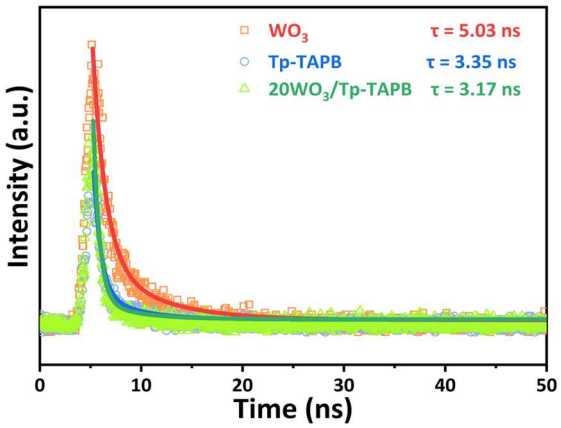

Fig. S5. TRPL spectra of WO_3, Tp-TAPB and $20WO_3$/Tp-TAPB

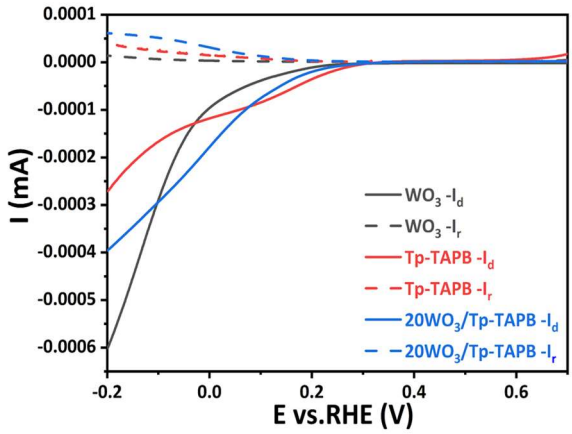

Fig. S6. LSV curves of WO_3, Tp-TAPB and $20WO_3$/Tp-TAPB obtained using an RRDE with a rotating speed of 1600 rpm

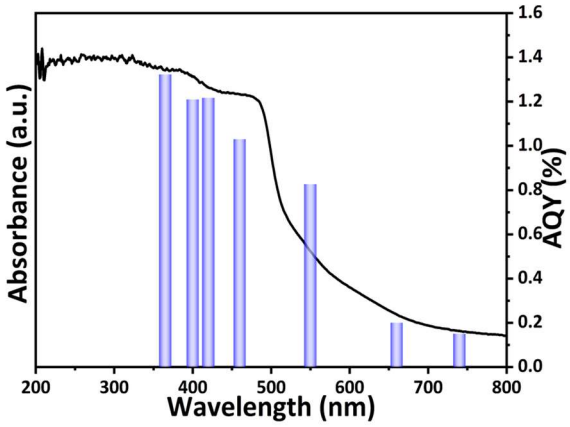

Fig. S7. AQY values of 20WO_3/Tp-TAPB under different monochromatic light irradiation and UV-visible DRS spectra

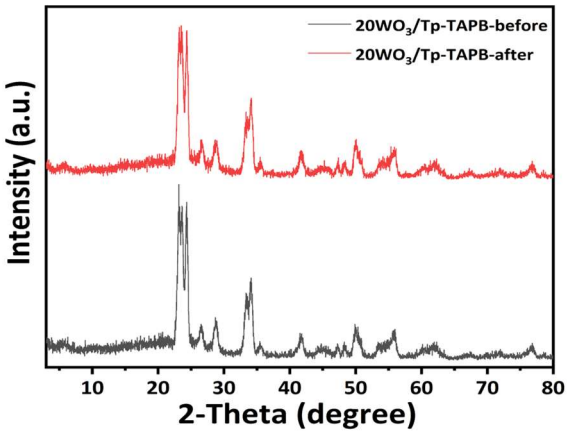

Fig. S8. XRD pattern of $20WO_3$/Tp-TAPB before and after photocatalytic reaction

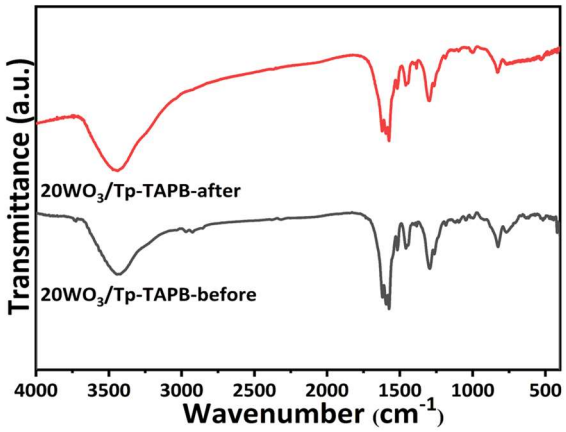

Fig. S9. FT-IR survey spectra of $20WO_3$/Tp-TAPB before and after photocatalytic reaction

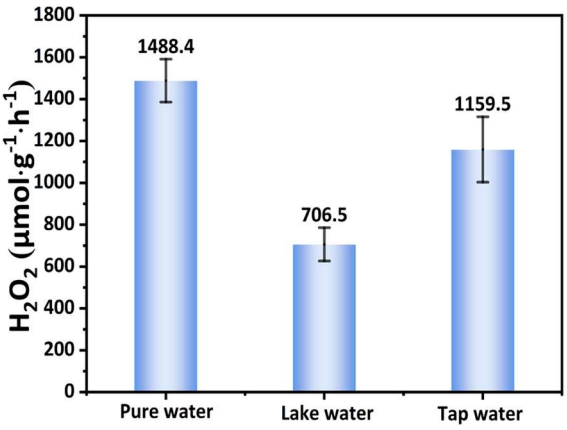

Fig. S10. The photocatalytic H_2O_2 production over 20WO_3/Tp-TAPB in tap water and lake water (Condition: 5 mg catalyst, 10 mL H_2O + O_2, LED light (λ > 420 nm))

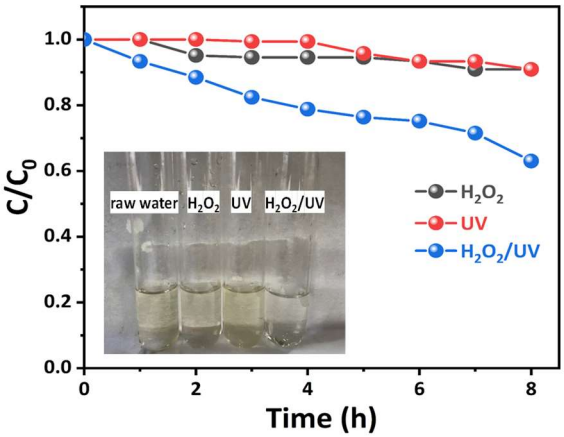

Fig. S11. The removal efficiency of COD by H_2O_2, UV and H_2O_2/UV (Raw water COD concentration = 110mg/L, 50 mL Coking water + 5 mL H_2O_2)

Table S1. BET surface areas of the samples

Samples	BET surface areas (m^2/g)
WO_3	7.02
Tp-TAPB	608.26
$5WO_3$/ Tp-TAPB	547.15
$10WO_3$/ Tp-TAPB	489.89
$20WO_3$/ Tp-TAPB	306.60
$30WO_3$/ Tp-TAPB	301.89
$40WO_3$/ Tp-TAPB	246.37

Table S2. The WO_3 composition of WO_3/Tp-TAPB

Samples	WO_3 composition (%)
5WO_3/Tp-TAPB	3.08
10WO_3/Tp-TAPB	11.62
20WO_3/Tp-TAPB	21.92
30WO_3/Tp-TAPB	26.29
40WO_3/Tp-TAPB	34.60

Table S3. Comparison of photocatalytic H_2O_2 production with other photocatalysts

Samples	H_2O_2 generation rate	Solvent	References
CHF-DPDA	256 μmol·g^{-1}·h^{-1}	H_2O	[1]
TPB-DMTP-COF	2882 μmol·g^{-1}·h^{-1}	H_2O	[2]
COF-TfpBpy	1970 μmol·L^{-1}·h^{-1}	H_2O	[3]
TiCOF-spn	489.94 μmol·g^{-1}·h^{-1}	H_2O	[4]
HEP-TAPT-COF	87.50 μmol·h^{-1}	H_2O	[5]
TAPB-PDA-H_2	1349.3 μmol·g^{-1}·h^{-1}	H_2O	[6]
TAPB-PDA-OH	1841.3 μmol·g^{-1}·h^{-1}	H_2O	[6]
TAPB-PDA-OCH_3	869.1 μmol·g^{-1}·h^{-1}	H_2O	[6]
TAPB-PDA-CH_3	857.8 μmol·g^{-1}·h^{-1}	H_2O	[6]
TAPD-$(Me)_2$COF	234.52 μmol·g^{-1}·h^{-1}	H_2O + EtOH	[7]
CTF-NS-5BT	1630 μmol·g^{-1}·h^{-1}	H_2O + BA	[8]
TpMa/CN-5	880.46 μmol·L^{-1}	H_2O + IPA	[9]
TiO_2/COF	740 μmol·L^{-1}·h^{-1}	furfuryl alcohol	[10]
$ZnIn_2S_4$/TpPa-1	516 μmol·L^{-1} (2h)	H_2O + EtOH	[11]
CDs@CTFs	535.41 μmol·g^{-1}·h^{-1}	H_2O	[12]
ZnO/COF	2443 μmol·g^{-1}·h^{-1}	H_2O + EtOH	[13]
$MnIn_2S_4$/WO_3	1188 μmol·g^{-1}·h^{-1}	H_2O	[14]
ZnO/WO_3	6788 μmol·L^{-1}·h^{-1}	H_2O + EtOH	[15]
KCN10/WO_3	1.33 mmol/L	H_2O + EtOH	[16]
Au/WO_3	544 μM	H_2O + MeOH	[17]
Tp-TAPB	528.3 μmol·g^{-1}·h^{-1}	H_2O	This work
20WO_3/Tp-TAPB	1488.4 μmol·g^{-1}·h^{-1}	H_2O	This work

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