Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Boosting photocatalytic degradation of ethyl acetate by Z-scheme Au-TiO_2@NH_2-UiO-66 heterojunction with ultrafine Au as electron mediator

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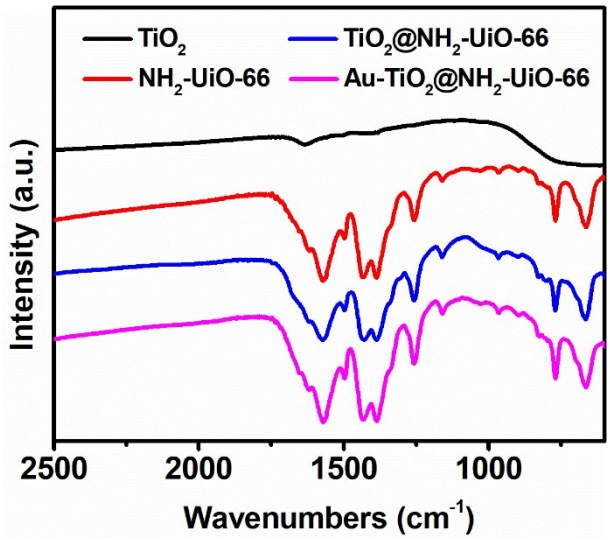

Fig. S1 FT-IR spectra of TiO_2, pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66 in the range of 400-2500 cm^{-1}.

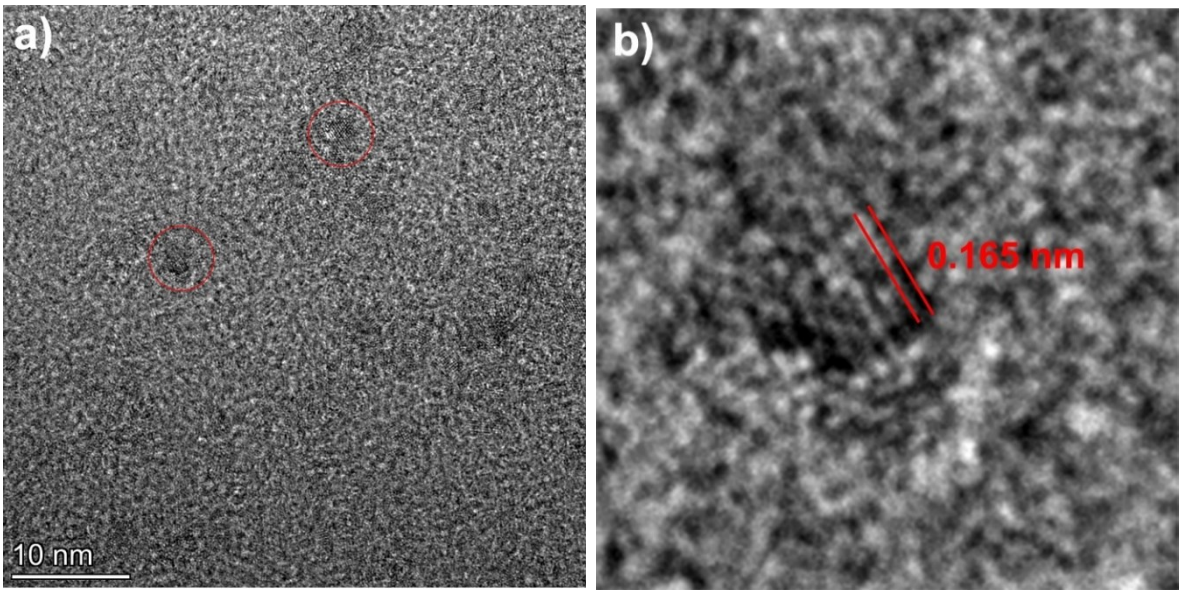

Fig. S2 TEM images of TiO_2.

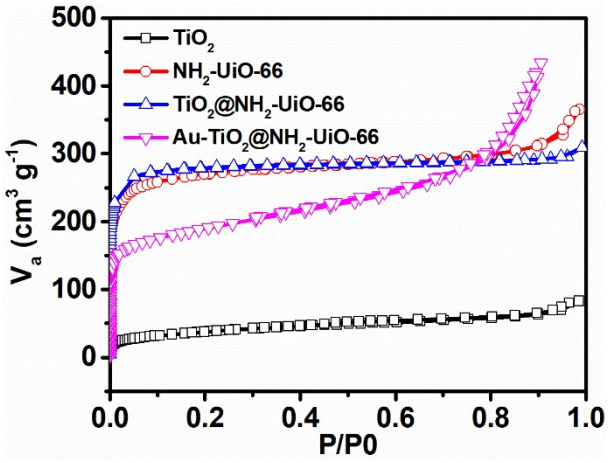

Fig. S3 N_2 adsorption-desorption isotherms of TiO_2, pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66.

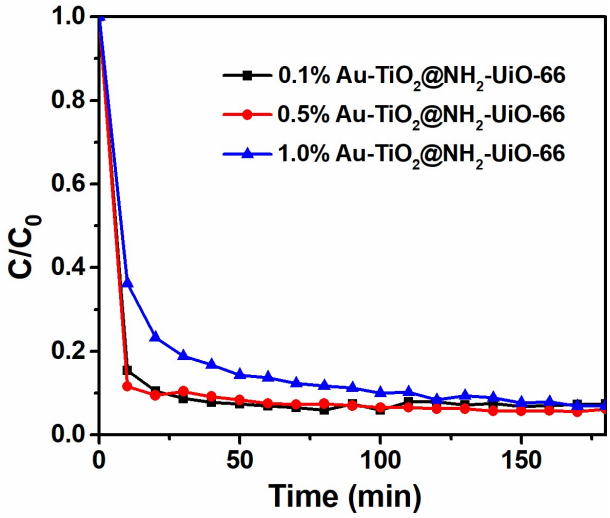

Fig. S4 Removal efficiencies of ethyl acetate during the photocatalytic oxidation by Au-TiO_2@NH_2-UiO-66 with different Au content.

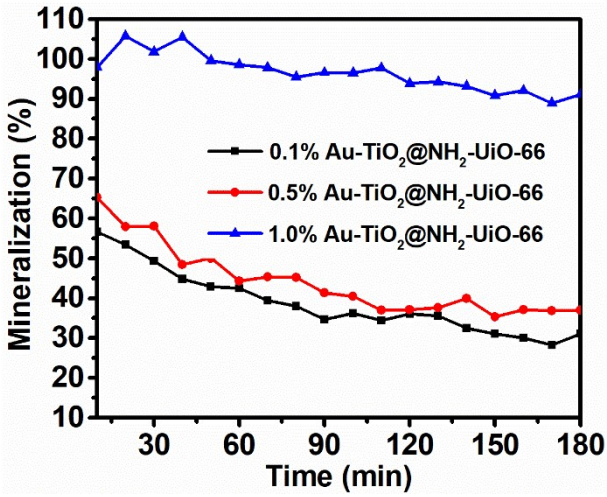

Fig. S5 Mineralization efficiencies of ethyl acetate during the photocatalytic oxidation by Au-TiO_2@NH_2-UiO-66 with different Au content.

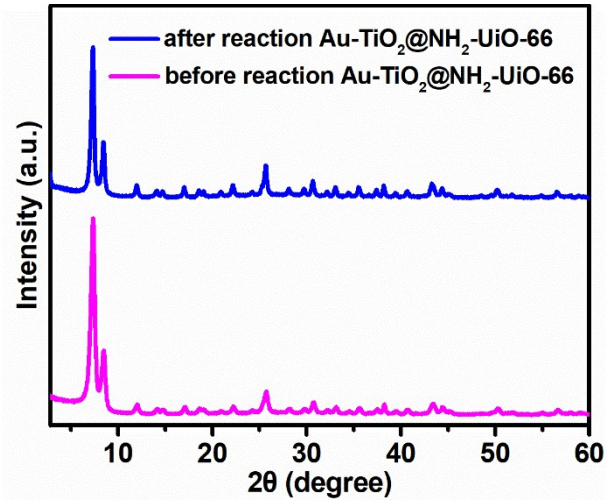

Fig. S6 Powder XRD patterns of before reaction (a)and after reaction Au-TiO_2@NH_2-UiO-66 samples.

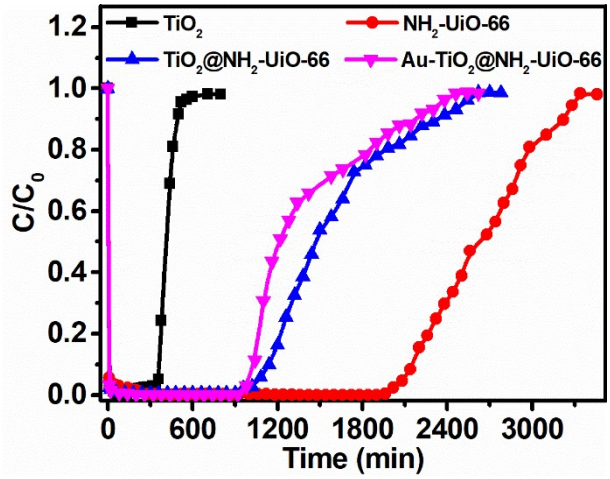

Fig. S7 Adsorption kinetic curves of ethyl acetate on TiO_2, pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66.

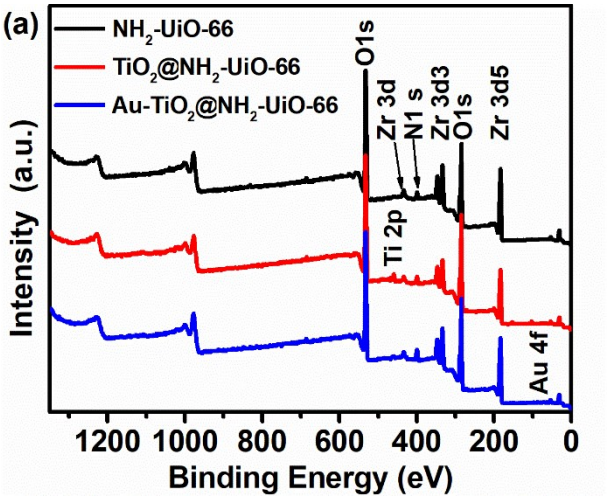

Fig. S8 XPS survey spectra of pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66 samples, respectively.

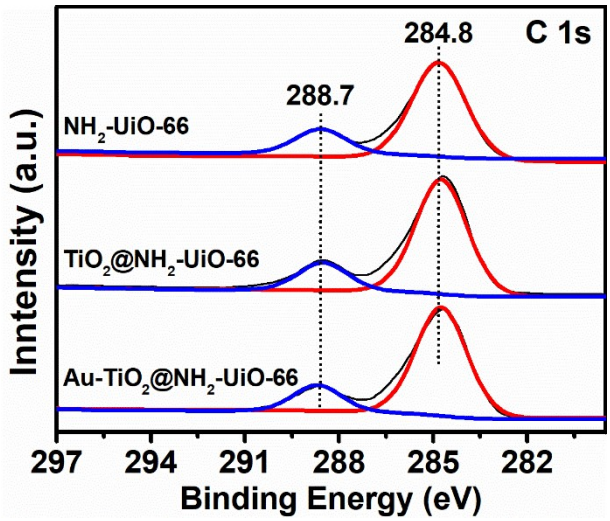

Fig. S9 XPS spectra of C 1s for pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66 samples, respectively

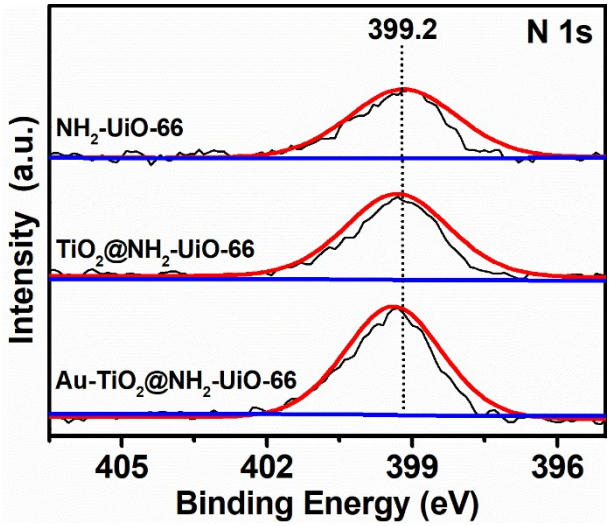

Fig. S10 XPS spectra of N 1s for pure NH_2-UiO-66, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66 samples, respectively

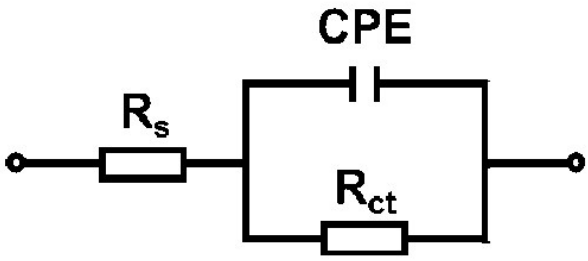

Fig. S11 the equivalent electrical circuit for EIS.

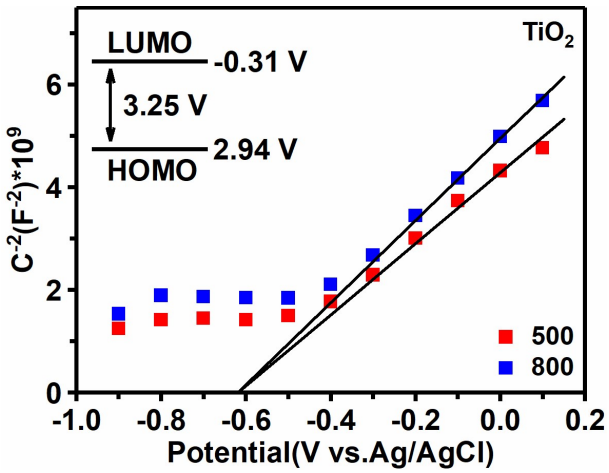

Fig. S12 Mott-Schottky plots for TiO_2 at frequencies of 500 and 800 Hz.

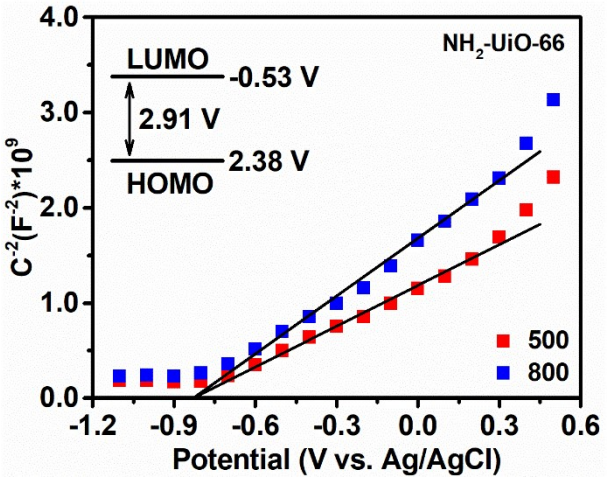

Fig. S13 Mott-Schottky plots for pure NH_2-UiO-66 at frequencies of 500 and 800 Hz.

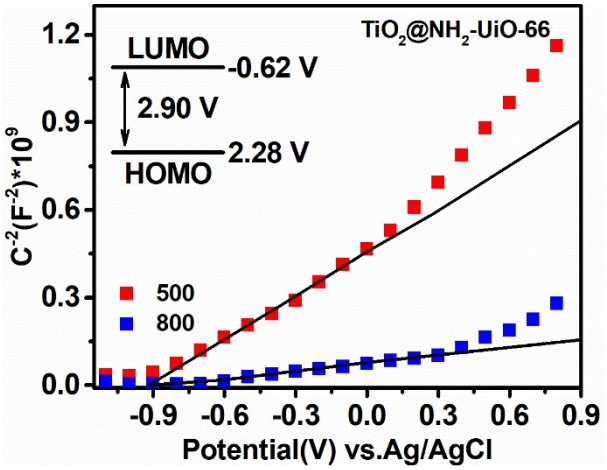

Fig. S14 Mott-Schottky plots for TiO_2@NH_2-UiO-66 at frequencies of 500 and 800 Hz.

Table S1 Characterization results of the samples by N_2 adsorption-desorption.

Sample	S_{BET} (m^2 g^{-1})	$S_{Langmuir}$ (m^2 g^{-1})	V_{pore} (cm^3 g^{-1})
TiO_2	126.9	134.0	0.07
NH_2-UiO-66	910.3	1275.6	0.41
TiO_2@NH_2-UiO-66	725.4	807.1	0.36
Au-TiO_2@NH_2-UiO-66	609.1	627.4	0.33

Table S2 Fitted TRPL parameters of TiO_2, TiO_2@NH_2-UiO-66 and Au-TiO_2@NH_2-UiO-66.

Sample	τ (ps)	τ_1 (ns)	A_1 (%)	τ_2 (ns)	A_2 (%)	τ_3 (ps)	A_3 (%)
NH_2-UiO-66	358.00	3.06	14.04	22.39	10.90	273.89	75.06
TiO_2@NH_2-UiO-66	100.47	2.92	13.01	23.71	12.17	75.55	74.82
Au-TiO_2@NH_2-UiO-66	88.75	2.92	14.03	24.01	11.24	70.59	74.73

Table S3 Fitting results for equivalent electrical circuits of different samples

Sample	Rs (Ω)	Rct (kΩ)	CPE (μf)
TiO_2	43.93	11.47	10.42
Pure MOF	44.32	15.21	9.73
TiO_2@MOF	50.12	3.67	10.94
Au-TiO_2@MOF	46.99	2.89	12.19

Table S4 Activity comparison between Au-TiO_2@NH_2-UiO-66 and the other typical MOF based photocatalysts for the photocatalytic degradation of VOCs

Catalyst	Dose (g)	VOCs Concentration	Flow rate (mL/min)	Light source	Con. (%)	Mineralization rate (%)	Time (min)	Stability	Ref.
GC-N-TiO_2	0.1	toluene, 25 ppmv	100	300W, Xe lamp	70	76	1440	Stable, 24 h	1
46 wt% TiO_2@NH_2-MIL-125	0.1	methanal, 10 ppmv	600	125W, Mercury lamp	90	＞99	2880	Stable, 122 h	2
Mesoporous TiO_2	1.0	benzene, 25 ppmv	1000	4W, 254 nm, UV lamp	90	15	130	90.0 % to 60.4% (18 h)	3
Pd-TiO_2	-	toluene, 105 ppmv	800	10 W, Mercury lamp	58	23	2280	Stable, 40 h	4
MIL-100(Fe)/α-Fe_2O_3-15	0.095	o-xylene, 50 ppmv	10	250 W, Xe lamp	100	-	300	Stable, 20 h	5
5 wt% TiO_2@NH_2-UiO-66	0.1	styrene, 30 ppmv	35	300W, Xe lamp	99	35	600	Stable, 10 h	6
Ni-MOF/NF	2×3 cm	ethyl acetate 70 ppmv	35	300W, Xe lamp	90	41	360	Stable, 6 h	7
		toluene			20	16			
		n-butanol			90	37			
1 wt% Au-TiO_2@NH_2-UiO-66	0.1	ethyl acetate	70	300W, Xe lamp	94.6	85	360	Stable, 6 h	This work

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