Supplementary Information

Multi-Interfacial Engineering of TiO2@TPA-Pt-CuPc Heterostructures for Highly Selective Photocatalytic CO2-to-CH4 Conversion

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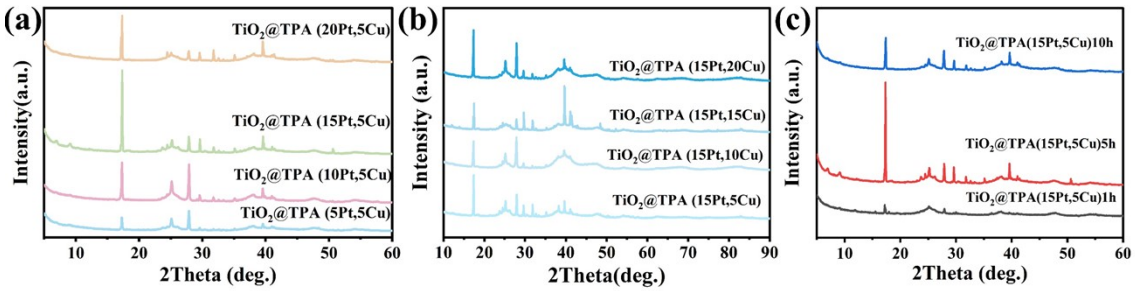

Figure S1.(a-b) XRD patterns with different loads of Pt and CuPc,(c) with different photodeposition times

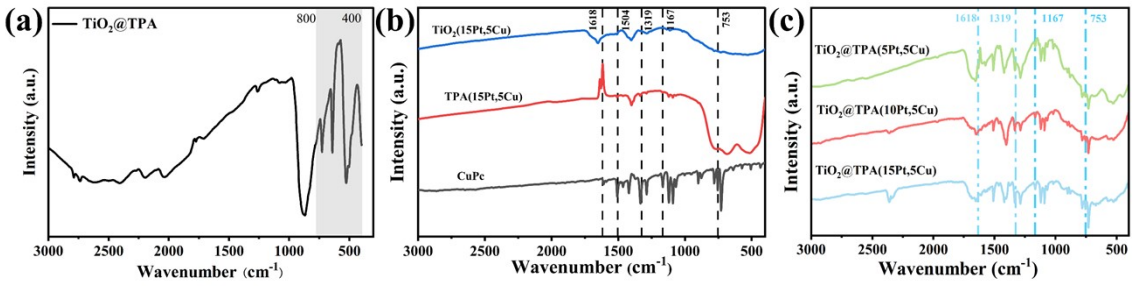

Figure S2. (a)FTIR of TiO_2@TPA (b) FTIR of TiO_2(15Pt,5Cu),TPA(15Pt,5Cu),CuPc (c) FTIR of TiO_2@TPA (5Pt,5Cu),TiO_2@TPA (10Pt,5Cu),TiO_2@TPA (15Pt,5Cu)

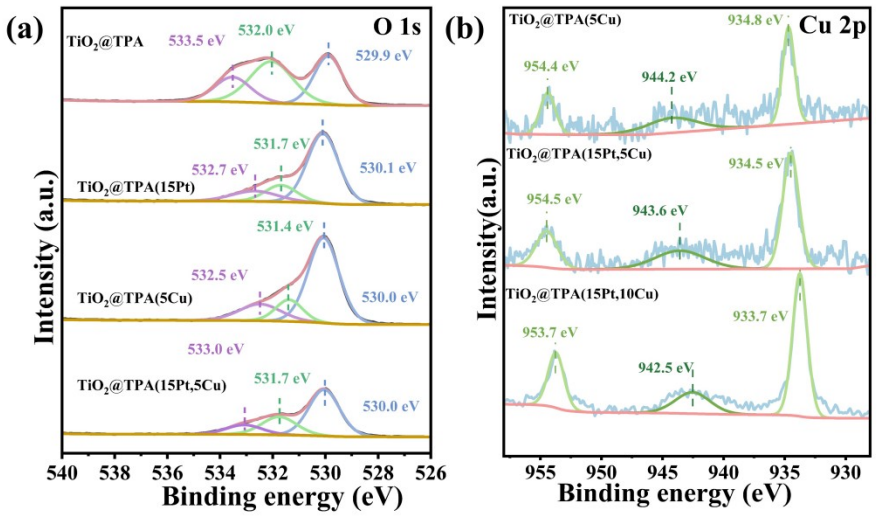

Figure S3. O 1s XPS spectra of TiO_2@TPA,TiO_2@TPA(15Pt),TiO_2@TPA(5Cu) and TiO_2@TPA(15Pt, 5Cu) (b) Cu 2pXPS spectrograms of TiO_2@TPA(5Cu),TiO_2@TPA(15Pt,5Cu), and TiO_2@TPA(15Pt,10Cu)

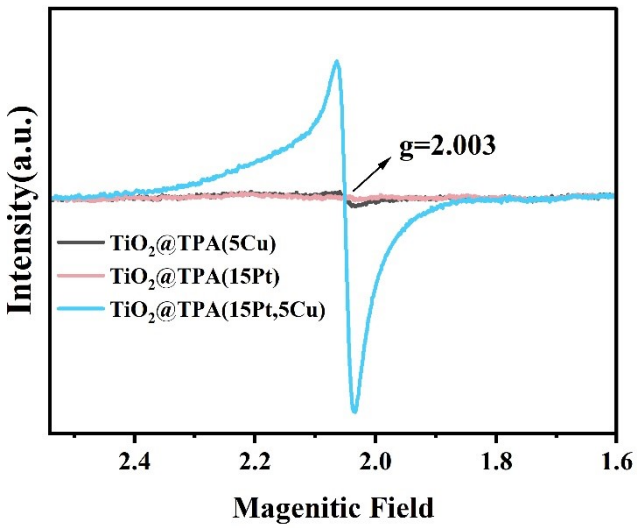

Figure S4. EPR of TiO_2@TPA(5Cu) ,TiO_2@TPA(15Pt) and TiO_2@TPA(15Pt,5Cu)

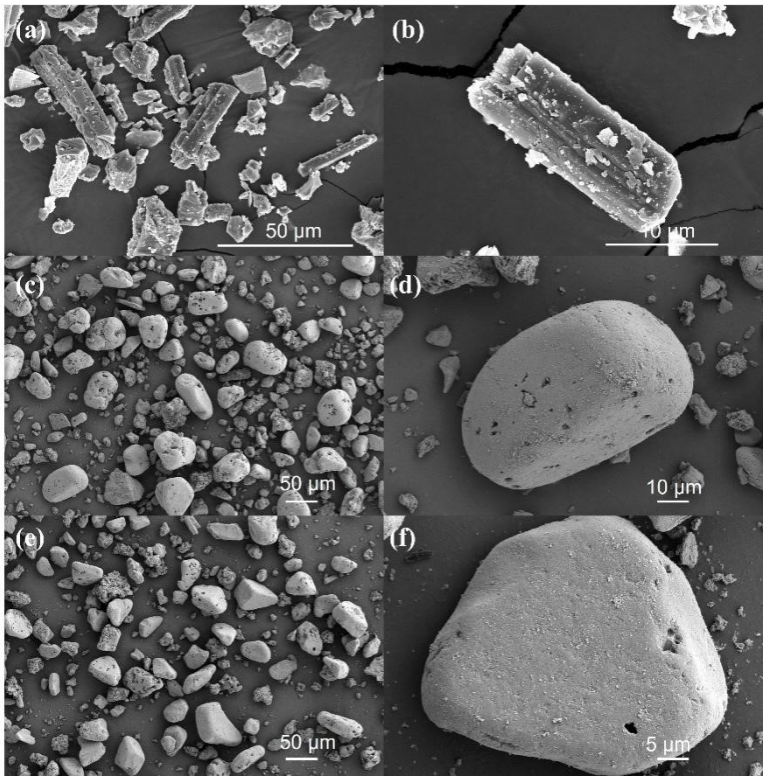

Figure S5. SEM images of(a,b)TiO_2@TPA**,**(c,d)TiO_2@TPA(5Cu), and (e, f)TiO_2@TPA(15Pt)

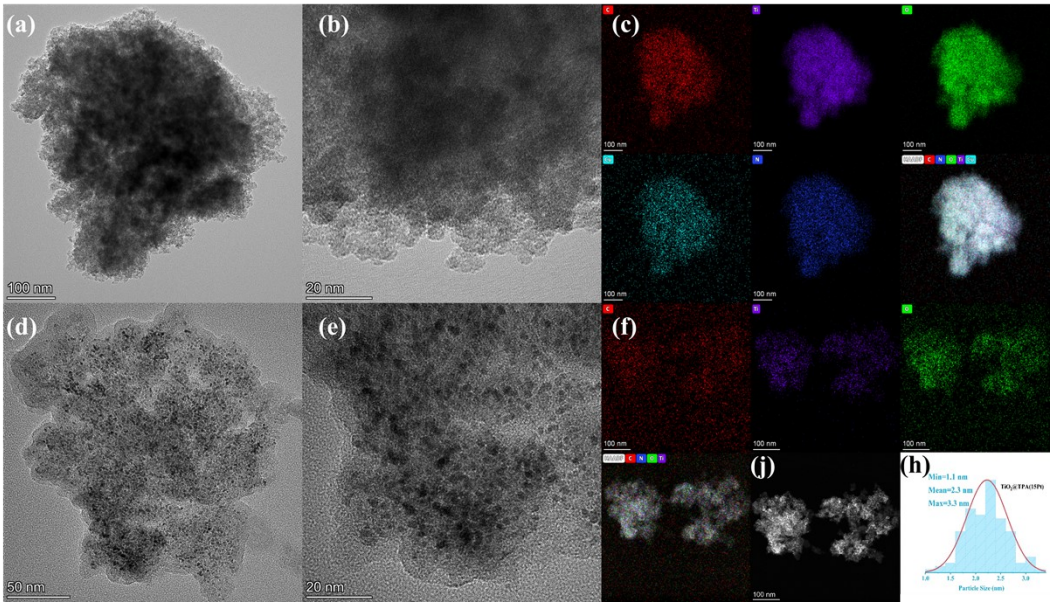

Figure S6. (a,b) TEM images of TiO_2@TPA(5Cu) (c) elemental mapping image of TiO_2@TPA(5Cu) (d,e) TEM images of TiO_2@TPA(15Pt) (f) elemental mapping image of TiO_2@TPA(15Pt) (j,h) HAADF TEM image and particle size distribution histogram of TiO_2@TPA(15Pt).

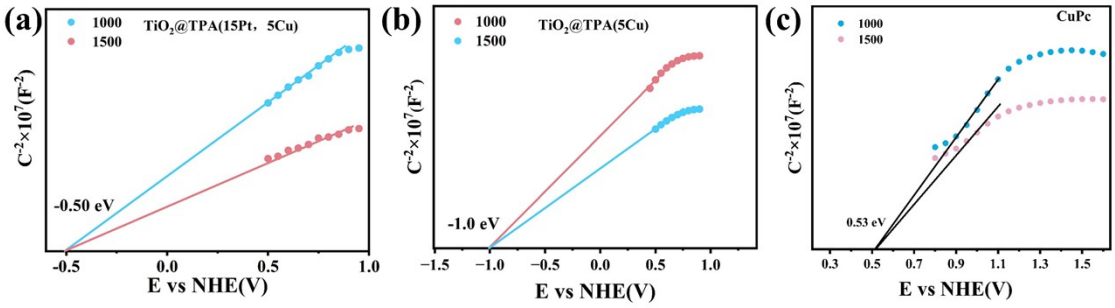

Figure S7. Moot-Schotty curves of TiO_2@TPA(15Pt,5Cu),TiO_2@TPA(5Cu) and CuPc

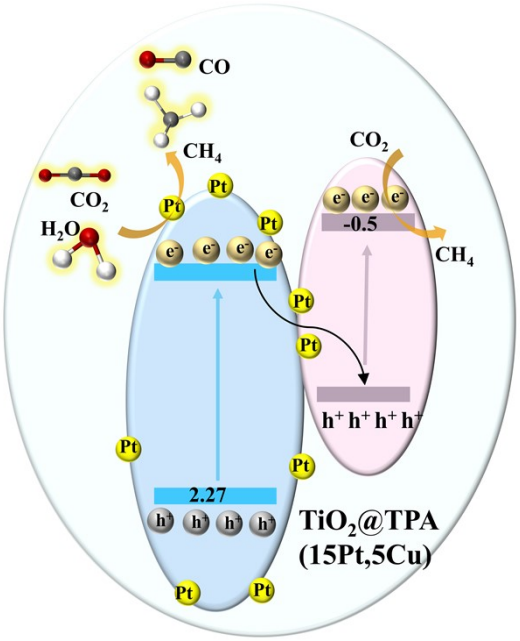

Figure S8. Band structure of TiO_2@TPA(15Pt,5Cu)

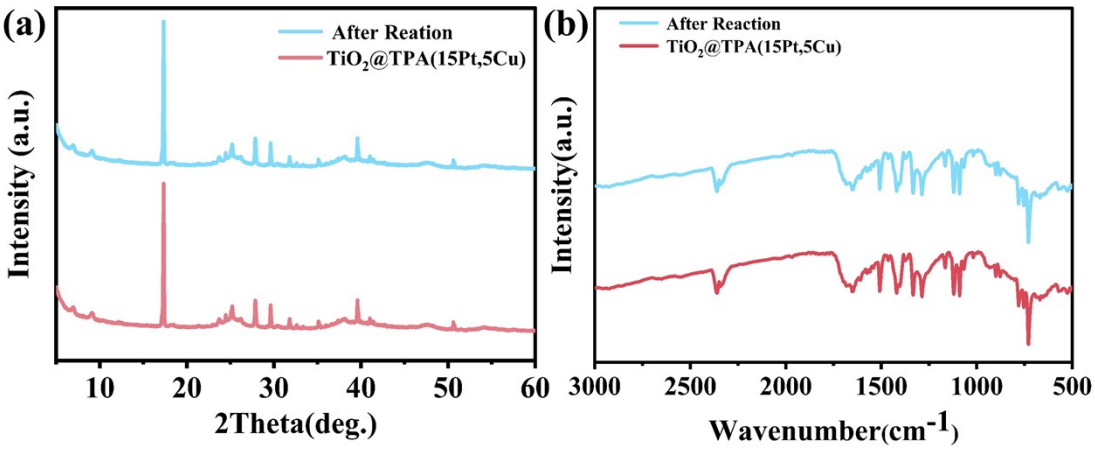

Figure S9. (a) XRD and (b) FTIR spectra of TiO_2@TPA(15Pt,5Cu) before and after the reaction

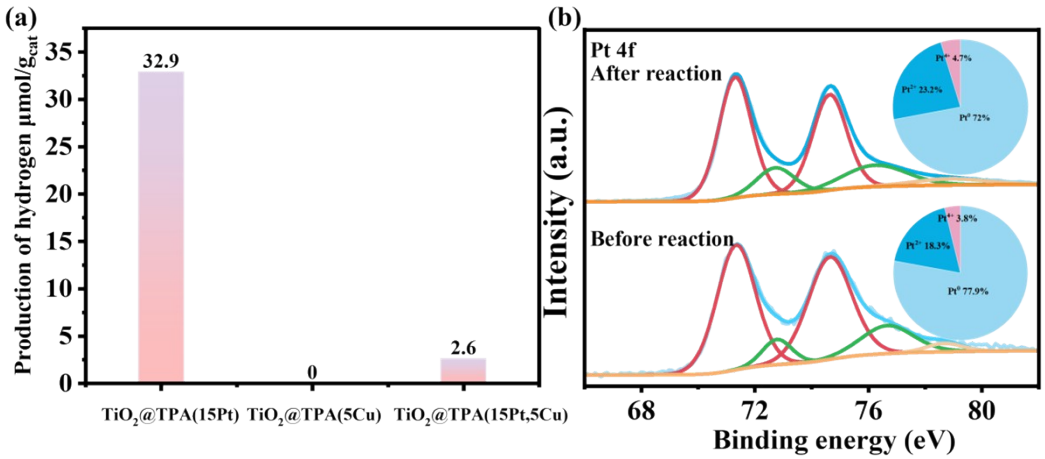

Figure S10. (a)Hydrogen evolution performance (b)Comparison of Pt 4f of XPS before and afterTiO$_2$@TPA(15Pt,5Cu) photocatalysis

Table S1. Pt Content of ICP Test Samples

Name of the material	Wt%
TiO$_2$@TPA (15Pt)	13.55%
TiO$_2$@TPA (5Pt,5Cu)	3.38%
TiO$_2$@TPA (10Pt,5Cu)	7.77%
TiO$_2$@TPA (15Pt,5Cu)	13.33%
TiO$_2$@TPA (20Pt,5Cu)	18.36%

Table S2. Comparison of the performance of titanium dioxide and MOF photocatalytic materials inconverting CO_2 to CO and CH_4 in recent years

Sample	Conditions	Products ($\mu mol\ g^{-1}h^{-1}$)	Reference
$Cu_{0.7}Au_{0.5}/TiO_2$	10 mg catalyst and 10mL H_2O A 300 W Xe lamp	CO:6.08	[1]
Cu/TiO_2-x	20mg catalyst $NaHCO_3$ with 0.5 M H_2SO_4 A 500 W Xe lamp (Oriel) coupled with UV cut-off filter	CO: 8.08 CH_4 : 1.33	[2]
H-TiO_2@Cu	10 mg catalyst and 1 mL H_2O A 300 W Xe lamp 10 cm from sample	CO: 10.58 CH_4 : 0.94	[3]
Pt/TiO_2-U	10 mg catalyst and H_2O A 300 W Xe lamp	CO: 54.2 CH_4 : 66.4	[4]
1% Ru-TiO_2-x	50 mg catalyst H_2O vapor A 300 W Xe lamp	CH_4 : 31.6	[5]
TiO_2/0.5CuPc	10 mg catalyst 25 ml aqueous methanol solution (40 vol%) A 300 W Xe lamp	CO:32.4 CH_4 :0.4	[6]
AuCu- TiO_2−xNS	50 mg catalyst suspended in 5 mLEtOH, H_2O vapor A 300 W Xe lamp	CO: 2.4 CH_4 : 22.5	[7]
Au1Pd_2-1.5%- TiO_2−x	2mg catalyst and H_2O A 300 W Xe lamp	CO: 1.10 CH_4 : 26.32	[8]
CuPc/Au- BVNS	50 mg catalyst and 5 mL H_2O A 300 W Xe lamp	CO: 6	[9]
TiO_2@TPA(15 Pt,5Cu)	10 mg catalyst 45mL H_2O+5mL TEOA A 300 W Xe lamp	CH_4 :99.8	This work

References

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