Electronic Supplementary Information

Enhanced Visible light photocatalytic nonoxygen coupling of amines to imines integrated with hydrogen production over Ni/CdS Nanoparticles†

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Table S1. Summary of the catalytic activity of literature reported photocatalysts for coupling of benzylamine to imine.

Entry	Catalyst	T [°C]	Atm.	Amines oxidation rate [μmol g^{-1} h^{-1}]	Ref. No.
1 [a]	Ni/CdS	20	N_2	45410	this work
2 [a]	Pt/MOF	RT	N_2	486	[1]
2	Au/TiO_2	RT	air	883	[2]
3	$[Au_{25}]/TiO_2$	30	O_2	39600	[3]
			Ar	1485	
4	$Au\text{-}Pd/ZrO_2$	45	O_2	198	[4]
5	$g\text{-}C_3N_4$	20	O_2	24503	[5]
6	$mpg\text{-}C_3N_4$	80	O_2	6000	[6]
			Ar	1600	
7 [b]	$Fe(bpy)_3/npg\text{-}C_3N_4$	RT	O_2	94 [%]	[7]
8	$BiVO_4/g\text{-}C_3N_4$	RT	O_2	1089	[8]
9	Nb_2O_5	RT	O_2	691	[9]
10 [b]	WS_2	50	O_2	94 [%]	[10]
			Ar	10 [%]	
11	$WO_3.H_2O$	80	O_2	1163	[11]
12	WO_3	RT	O_2	950	[12]
13	TiO_2	RT	air	1100	[13]
14	BiOBr	25	air	71	[14]

[a] To introduce water into the reaction systems. [b] x [%] express the imine yield

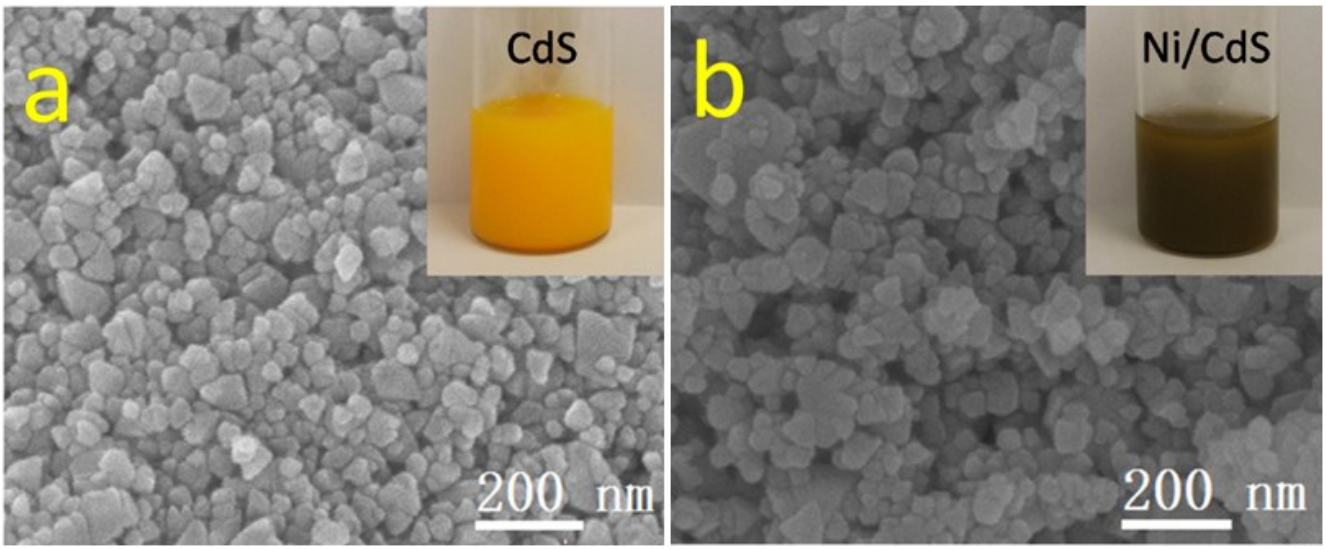

Figure S1. SEM images of (a) CdS NPs and (b) Ni/CdS. Insets are the photographs of the photocatalyt systems before and after in situ photodeposition of metallic Ni.

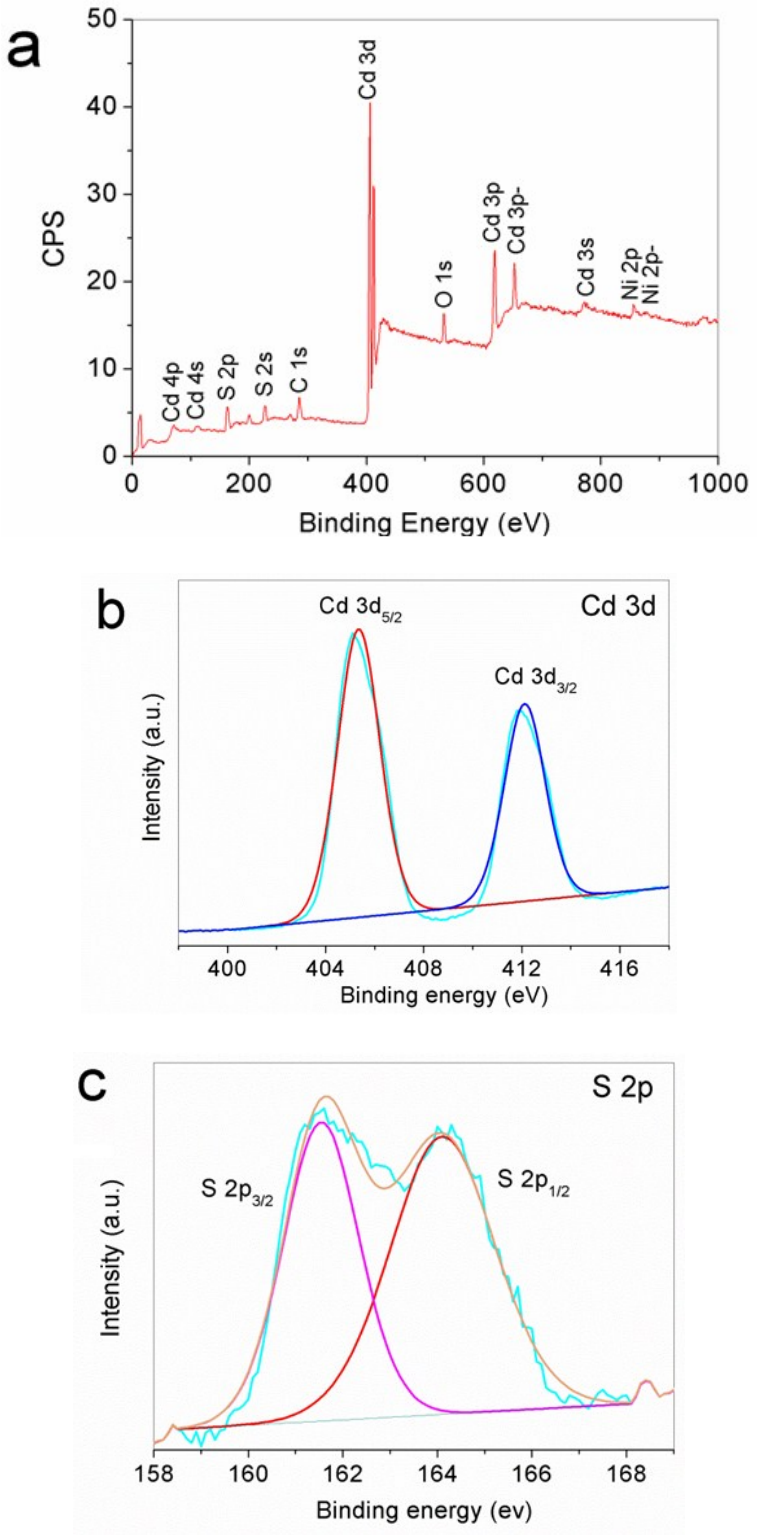

Figure S2. XPS spectra of Ni/CdS photocatalyst: (a) full spectrum, (b) Cd 3d, (c) S 2p.

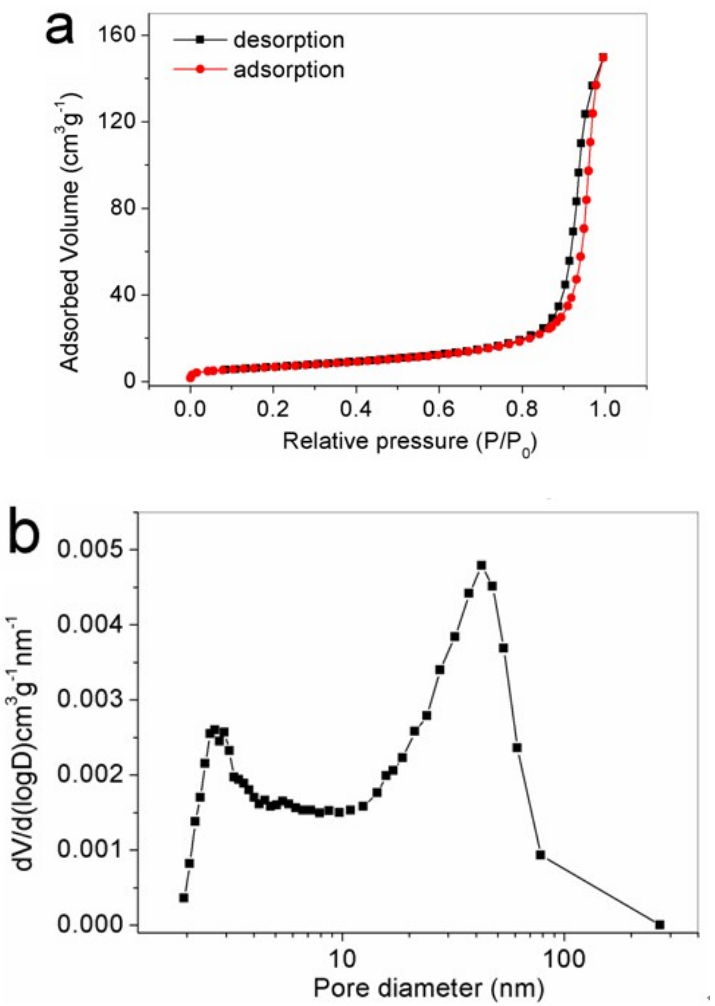

Figure S3. Nitrogen adsorption-desorption isotherms (a) and BJH pore size distribution from adsorption branch (b) of the as-prepared CdS NPs.

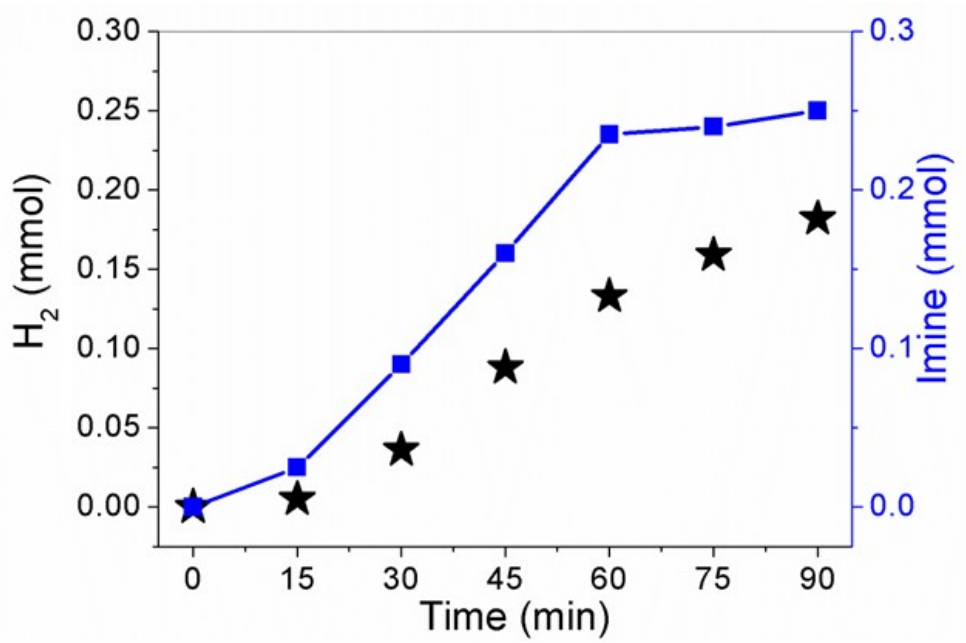

Figure S4. The amount of H_2 production and the imine base on the proposed mechanism of reaction, the ratio of H_2 and benzylamine oxidative prouduct should be 1: 2. The amount of H_2 production and the imine basically follow the ratio (1:2) in the Fig. S4.

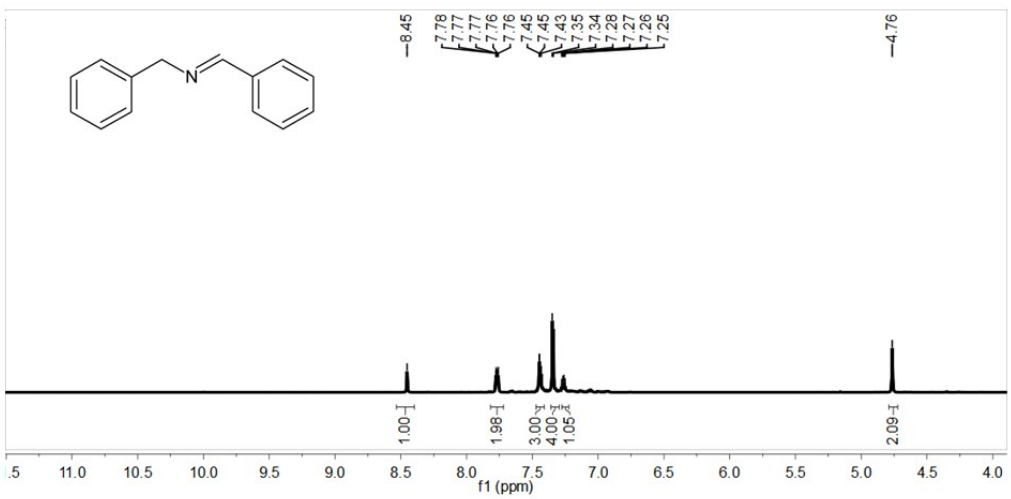

Figure S5. ^{1}H NMR spectrum of the as-synthesized benzenemethanamine ($C_{14}H_{13}N$). **1H NMR** (500 MHz, CD_3CN): δ 8.45 (s, 1H), 7.82 – 7.72 (m, 2H), 7.47 – 7.41 (m, 3H), 7.34 (d, J = 4.4 Hz, 4H), 7.28 – 7.22 (m, 1H), 4.76 (d, J = 1.0 Hz, 2H) ppm.

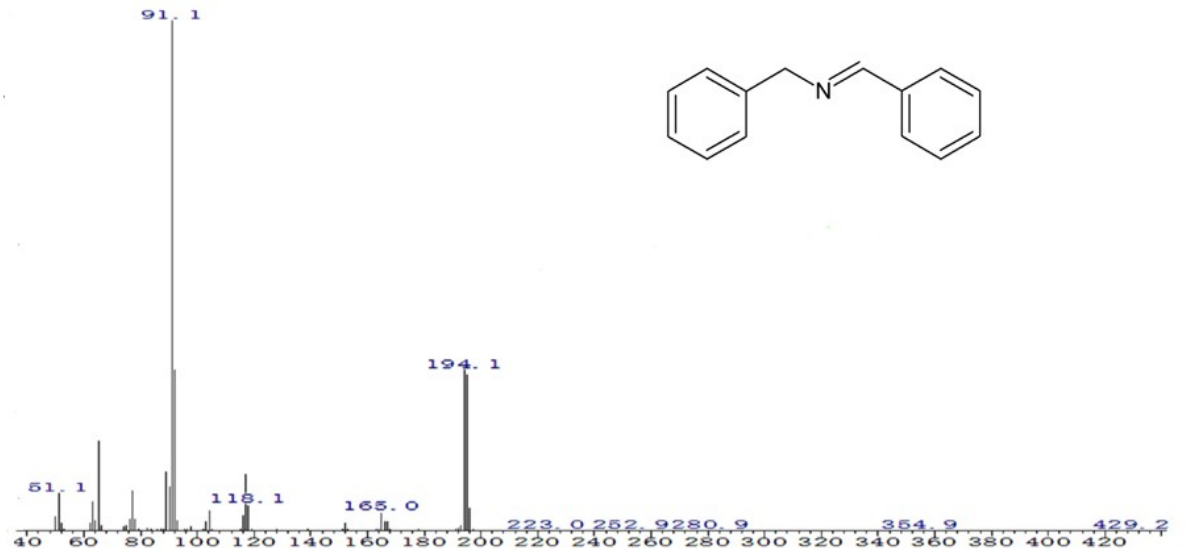

Figure S6. GC-MS spectrum of benzenemethanamine ($C_{14}H_{13}N$)

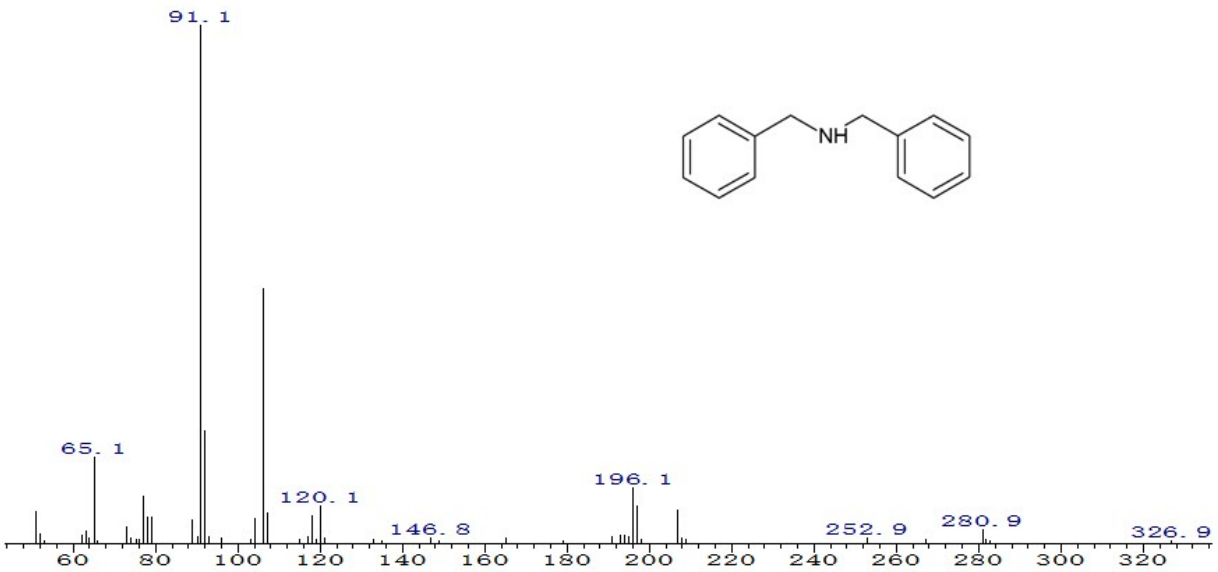

Figure S7. GC-MS spectrum of dibenzylamine ($C_{14}H_{16}N$).

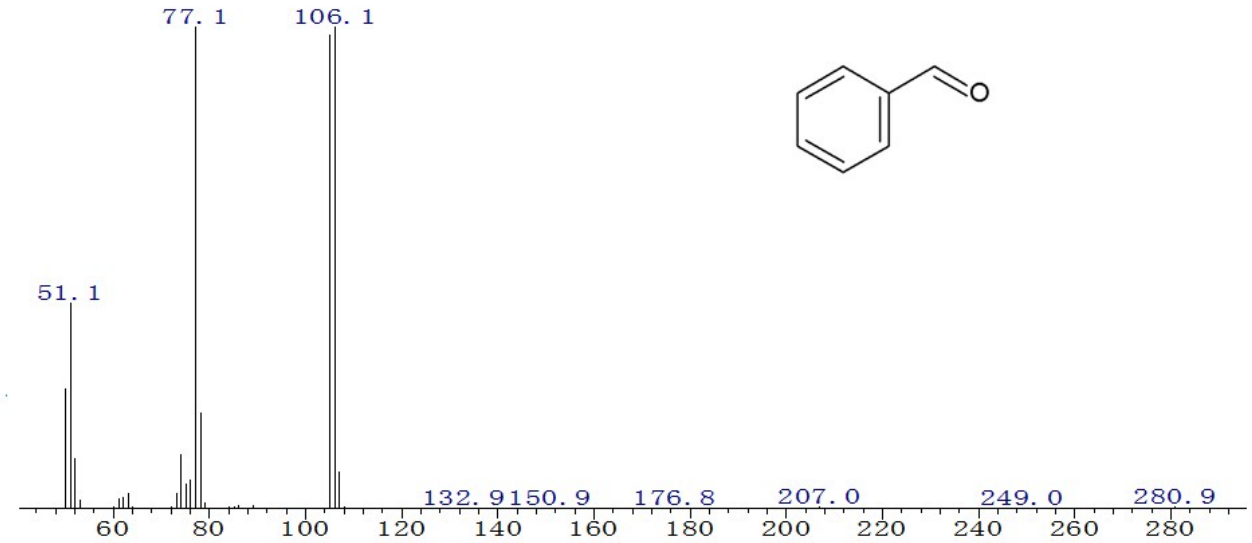

Figure S8. GC-MS spectrum of benzaldehyde (C_6H_5CHO).

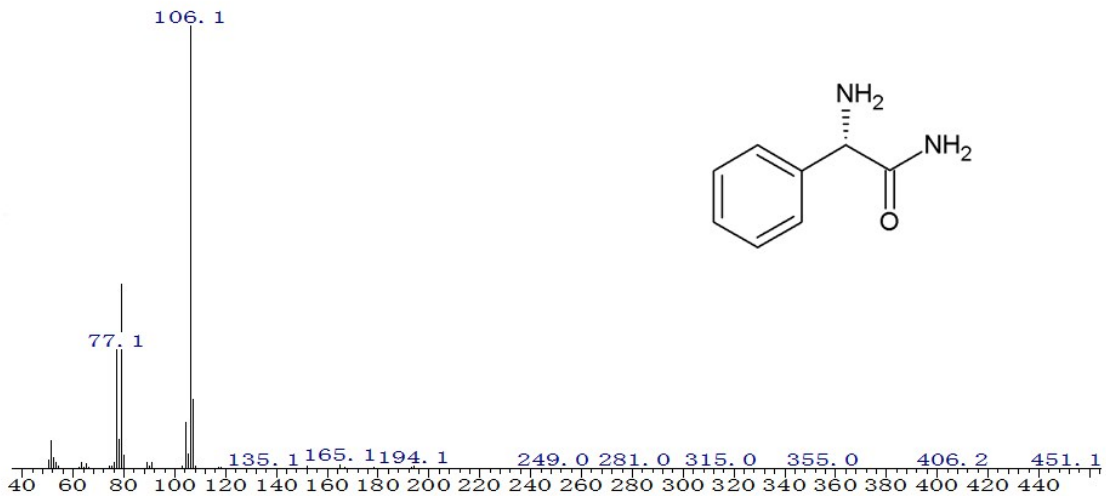

Figure S9. GC-MS spectrum of 2-Amino-2-phenylacetamide ($C_8H_{10}N_2O$).

4. Reference

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