Supporting Information

CTF Stabilizes Truncated Octahedral Cu_2O Nanocrystals and SnO_2 Nanoparticles Assisted Photocatalytic CO_2 Reduction in Hybrid Ternary Cu_2O/SnO_2/CTF Nanostructures

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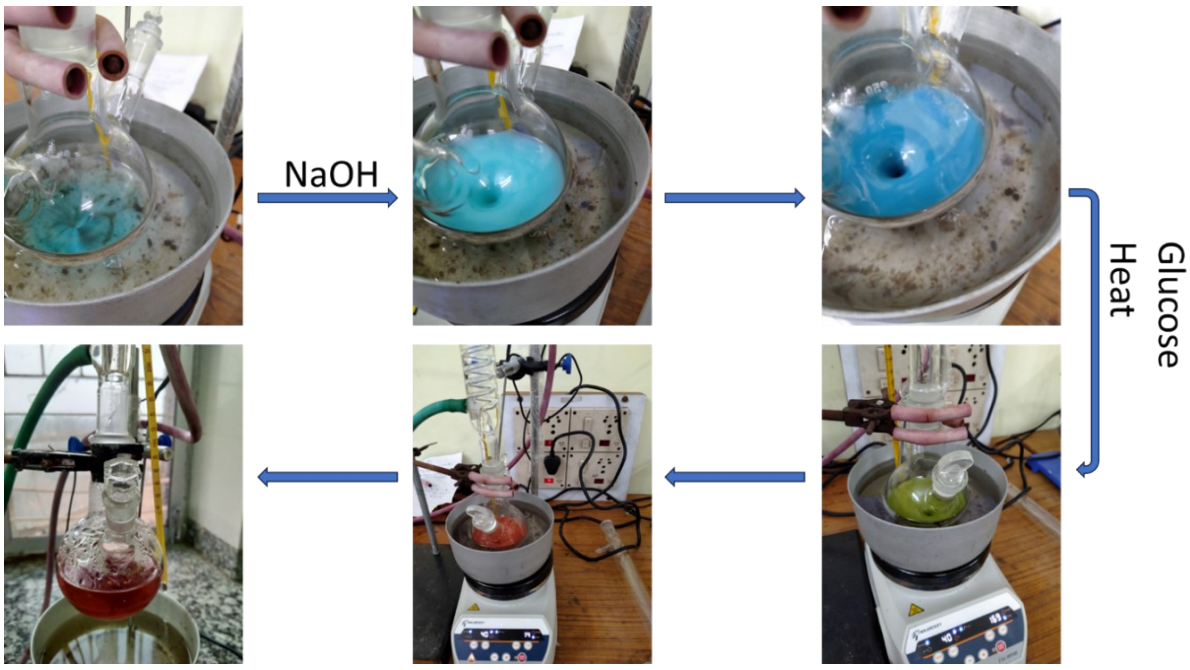

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Fig. S1 Synthesis of truncated octahedral Cu_2O NCs using NaOH and D(+)glucose. Colour changes during the course of reactions at different stages.

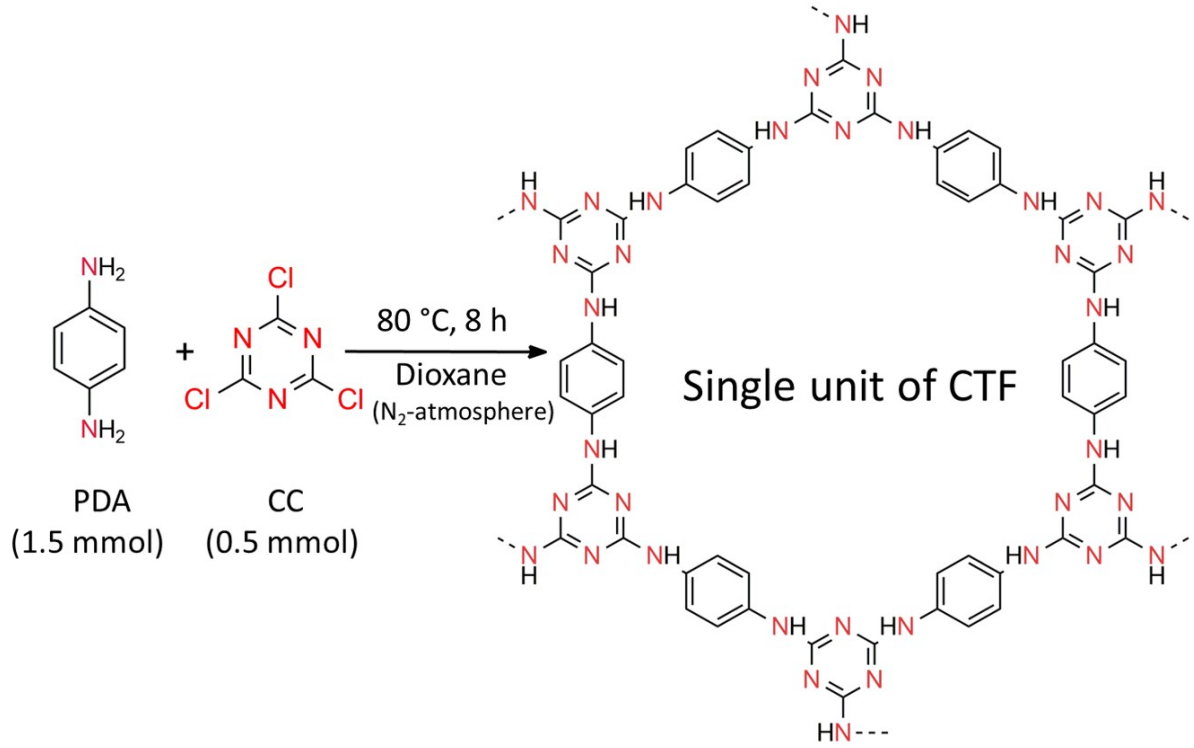

Fig. S2 Synthesis of covalent triazine based framework (CTF) using PDA and CC in 1,4-dioxane under N_2-atmosphere.

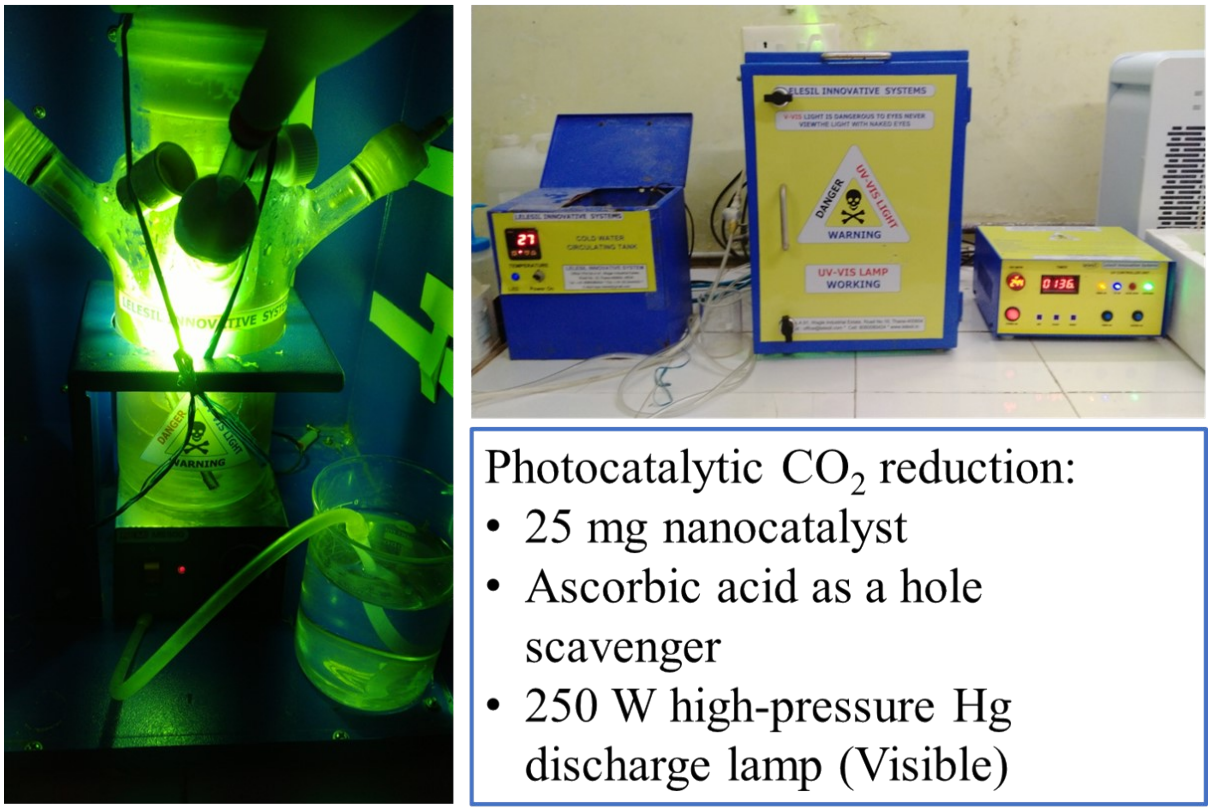

Fig. S3 Photocatalytic CO_2 reduction setup. Reactor volume: 1000 mL, headspace volume: 400 mL.

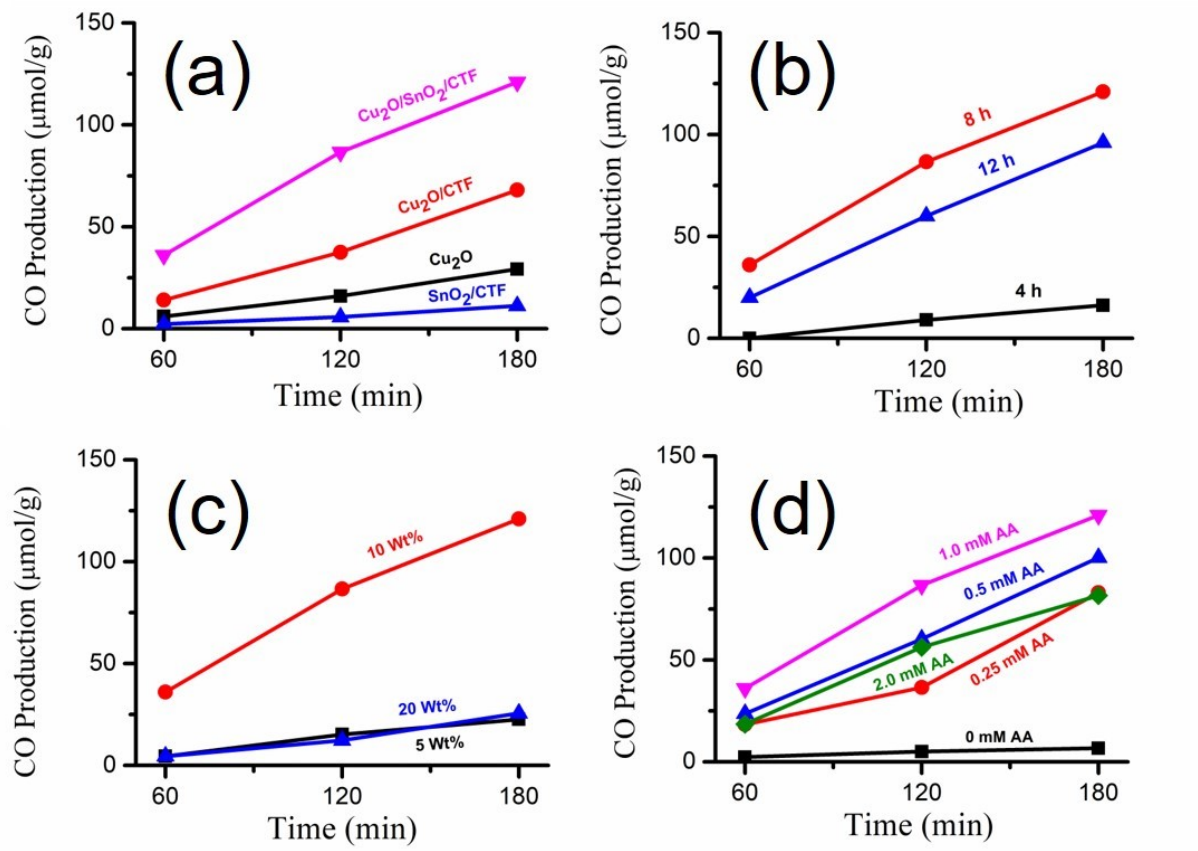

Fig. S4 (a) CO production rate for Cu_2O, Cu_2O/CTF, SnO_2/CTF and Cu_2O/SnO_2/CTF NCs using 25 mg catalyst and 1mM AA. (b) CTF thickness dependent CO production rate. (c) SnO_2 loading amount dependent CO and CH_4 formation. (d) Amount of AA with Cu_2O/SnO_2/CTF dependent product formation.

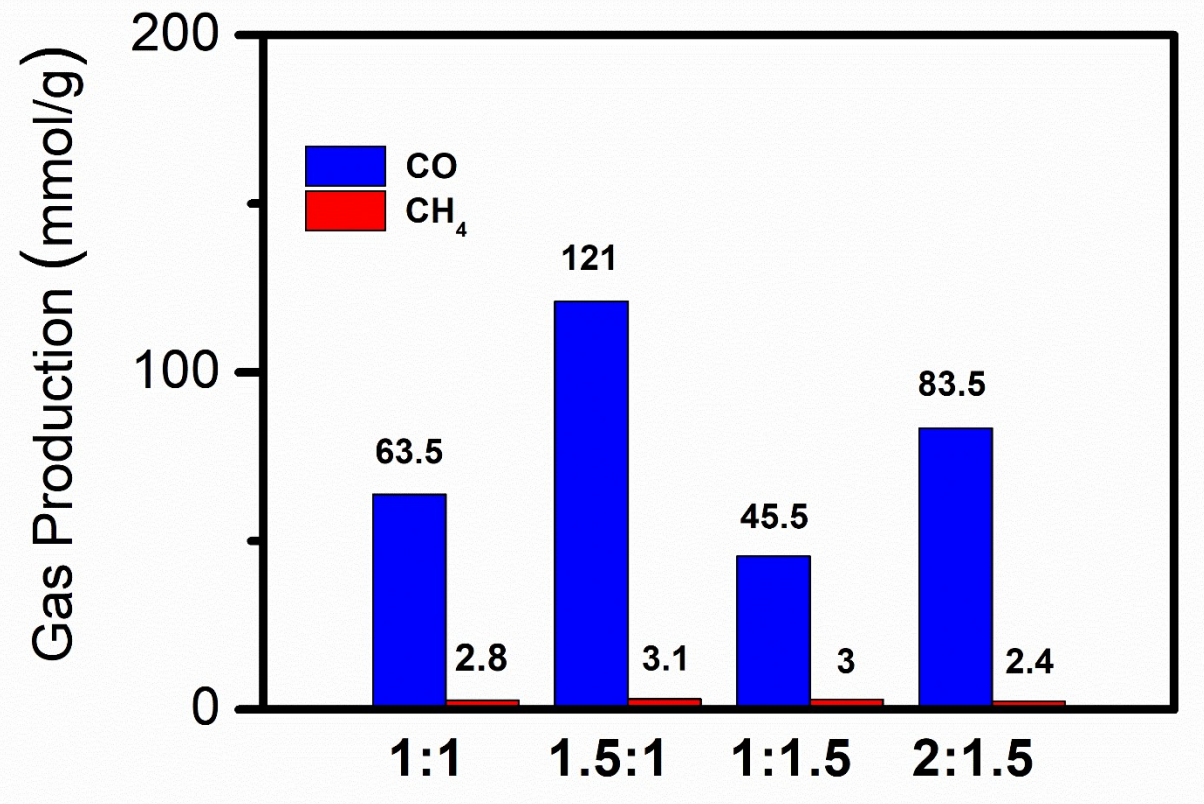

Fig. S5 Effect of CTF coating thickness on the product formation in photocatalytic CO_2RR using 25 mg $Cu_2O@SnO_2@CTF$ NCs catalyst and 1 mM AA. CTF coating thickness was varied by using CC and PDA ratio in mmol.

Calculation of Gaseous products in Gas Chromatogram:

$$\text{Production gas} = \frac{A_{sample} \times V_{hs} \times S_{ref}}{A_{ref} \times 22.4 \times W_{cat}} \text{ (µmol/g)}$$

where,

A_{sample} = the area of the respective peak in GC for the sample gas.

V_{hs} = volume of the head-space in cm^{-3}.

S_{ref} = concentration of reference gas in ppm.

A_{ref} = the area of the respective peak in GC for the reference gas.

W_{cat} = amount of catalyst in mg.

Table S1: Comparison of photocatalytic CO_2 reduction activities of covalent organic based framework related photocatalysts with Cu_2O/SnO_2/CTF under similar experimental conditions

Sl. No.	Photocatalyst	Light Source	Catalyst loading (mg/L)	Scavenger	Products ($\mu mol\ g^{-1}h^{-1}$)		Reference
					CO	CH_4	
1	Cu_2O@Cu@UiO-66-NH_2	Vis light	8571	TEOA in Acetone	20.9	8.3	[1]
2	Donor Acceptor CTF	Vis light	10000	TEOA in MeCN	85.71	-	[2]
3	Re-bpy-sp^2c-COF	Vis light	200	TEOA in MeCN	1040*	-	[3]
4	BTT-bpy-COF-Re	Vis light	6666	H_2O in Acetone	110.9	-	[4]
5	Nitrogen self-doped CTF	Vis light	400	TEOA in H_2O	1.96	11.48	[5]
6	$CuCo_2O4$/CTF	Vis light	11111	TEOA in H_2O and MeCN	14.9	-	[6]
7	Ni-TpBpy	Vis light	2000	TEOA in H_2O and MeCN	811.4*	-	[7]
8	$CuCo_2O_4$/CTF	Visible light	7777	TEOA in MeCN	14.9	-	[8]
9	**Cu_2O/SnO_2/CTF**	**Vis light**	**41**	**AA in H_2O**	**40.33**	**1.03**	**This Work**

Note:

*: In presence of a photosensitizer

TEOA: Triethanolamine

AA: Ascorbic Acid

Vis: Visible

References:

1 S.-Q. Wang, X.-Y. Zhang, X.-Y. Dao, X.-M. Cheng and W.-Y. Sun, *ACS Appl. Nano Mater.*, 2020, **3**, 10437–10445.

2 H. Zhong, Z. Hong, C. Yang, L. Li, Y. Xu, X. Wang and R. Wang, *ChemSusChem*, 2019, **12**, 4493–4499.

3 Z. Fu, X. Wang, A. M. Gardner, X. Wang, S. Y. Chong, G. Neri, A. J. Cowan, L. Liu, X. Li and A. Vogel, *Chem. Sci.*, 2020, **11**, 543–550.

4 H. Dong, H.-T. Che, L.-W. Bai, N.-N. Zhang, Y.-Q. Tian, B.-Z. Li, Y. Wang, X. Zhang and F.-M. Zhang, *Inorg. Chem.*, 2024, **63**, 24421–24428.

5 Q. Niu, Z. Cheng, Q. Chen, G. Huang, J. Lin, J. Bi and L. Wu, *ACS Sustain. Chem. Eng.*, 2021, **9**, 1333–1340.

6 G. Lin, L. Sun, G. Huang, Q. Chen, S. Fang, J. Bi and L. Wu, *Sustain. Energy Fuels*, 2021, **5**, 732–739.

7 W. Zhong, R. Sa, L. Li, Y. He, L. Li, J. Bi, Z. Zhuang, Y. Yu and Z. Zou, *J. Am. Chem. Soc.*, 2019, **141**, 7615–7621.

8 Z. Fu, X. Wang, A. M. Gardner, X. Wang, S. Y. Chong, G. Neri, A. J. Cowan, L. Liu, X. Li and A. Vogel, *Chem. Sci.*, 2020, **11**, 543–550.