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

Supporting Information

Synthesis and characterization of Zn_2GeO_4/Mg-MOF-74 composites with enhanced photocatalytic activity for CO_2 reduction

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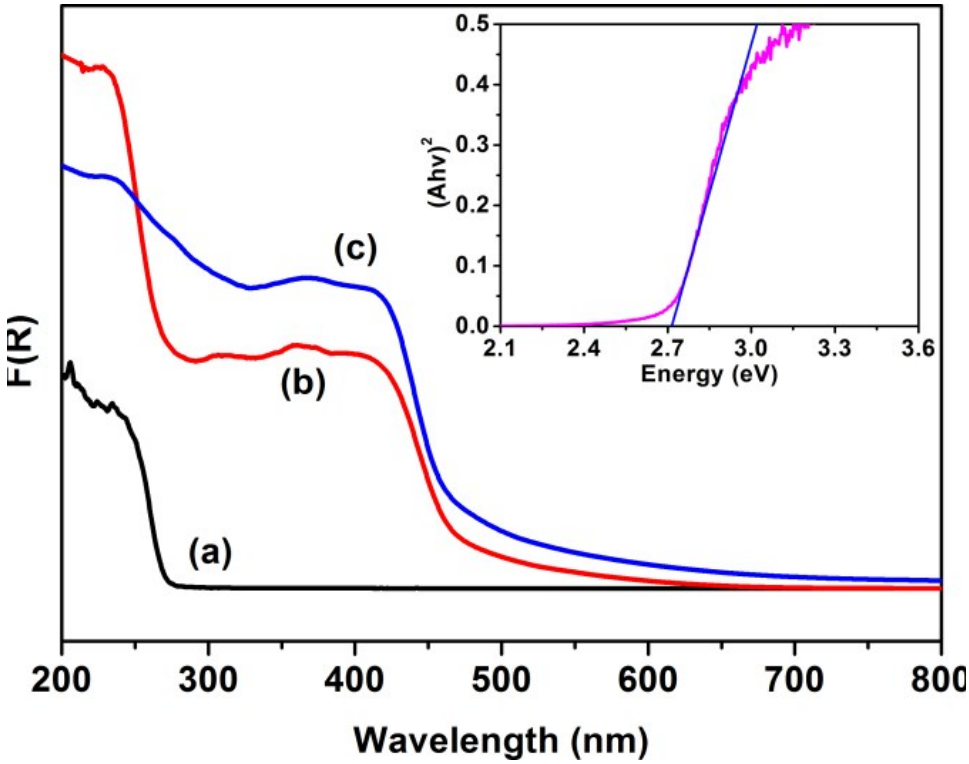

Fig. S1. UV-visible adsorption spectra of (a) Zn_2GeO_4, (b) Zn_2GeO_4/ Mg-MOF-74 and (c) Mg-MOF-74.

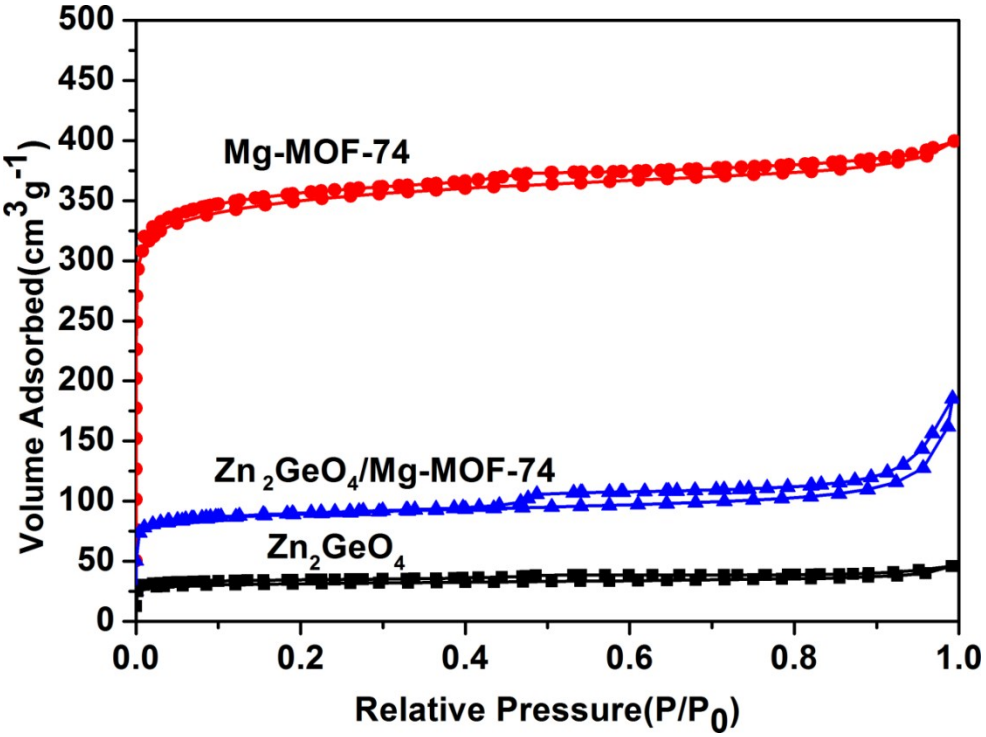

Fig. S2. N_2 adsorption isotherms(77K) of the as-prepared samples.

Table S1 Comparison of the reaction conditions and performances with other catalysts for photocatalytic CO_2 reaction.

Catalyst	Light source	Reduction medium	Products	Activity	Reference
Zn_2GeO_4/Mg-MOF-74.	300W Xenon arc lamp	Saturated CO_2 in mixture of water and MeCN, 1atm	CO and trace HCOOH	1.45 $\mu mol \cdot g^{-1} \cdot h^{-1}$	This work
Zn_2GeO_4 nanoribbons	300W Xenon arc lamp	Saturated CO_2 in water, 1 atm	CH_4	0.41 $\mu mol \cdot g^{-1} \cdot h^{-1}$	Lu et al. (ref.[1])
1wt% Pt-loaded Zn_2GeO_4 nanoribbons	300W Xenon arc lamp	Saturated CO_2 in water, 1 atm	CH_4	0.54 $\mu mol \cdot g^{-1} \cdot h^{-1}$	Lu et al. (ref.[1])
1 wt% RuO_2 -loaded Zn_2GeO_4 nanoribbons	300W Xenon arc lamp	Saturated CO_2 in water, 1 atm	CH_4	2.04 $\mu mol \cdot g^{-1} \cdot h^{-1}$	Lu et al. (ref.[1])
micro/mesoporous Zn_2GeO_4	300W Xenon arc lamp	0.5ml H_2O, high purity CO_2 gas (1atm)	CH_4	2.96 $\mu mol \cdot g^{-1} \cdot h^{-1}$	Zhang et al (ref. [2])
1wt% Pt-loaded micro/mesoporous Zn_2GeO_4	300W Xenon arc lamp	0.5ml H_2O, high purity CO_2 gas (1atm)	CH_4	9.03 $\mu mol \cdot g^{-1} \cdot h^{-1}$	Zhang et al (ref. [2])

Zn_2GeO_4 nanorods	300W Xenon arc lamp	0.4ml H_2O, high purity CO_2 gas (1atm)	CH_4 and CO	CO: 0.64μmol·g^{-1}·h^{-1}; CH_4: 0.24μmol·g^{-1}·h^{-1}	Yan et al (ref.[3])
ZIF-8/Zn_2GeO_4 nanorods	500W xenon arc lamp	Saturated CO_2 in water, 0.1M Na_2SO_3	CH_3OH	0.22 μmol·g^{-1}·h^{-1}	Lu et al. (ref.[4])
Hydroxylated Zn_2GeO_4-Cl nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	1.53μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
Zn_2GeO_4-Cl nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	1.06μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
Hydroxylated Zn_2GeO_4-NO_3 nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.82μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
Zn_2GeO_4-NO_3 nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.575μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
Hydroxylated Zn_2GeO_4-SO_4 nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.276μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
Zn_2GeO_4-SO_4 nanorods	300W Xenon arc lamp	1 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.07μmol·g^{-1}·h^{-1}	Yan et al (ref.[5])
1wt% RuO_2-loaded Zn_2GeO_4 nanorods	300W Xenon arc lamp	0.4 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.068μmol·g^{-1}·h^{-1}	Yang et al (ref.[6])

with CTAB

1wt% RuO_2-loaded Zn_2GeO_4 nanorods	300W Xenon arc lamp	0.4 ml H_2O, high purity CO_2 gas (1atm)	CH_4	0.28 μmol·g^{-1}·h^{-1}	Yang et al (ref.[6])
Zn_2GeO_4 nanorods	300W Xenon arc lamp	0.4 ml H_2O, High purity CO_2 gas (1atm)	CH_4	0.19 μmol·g^{-1}·h^{-1}	Wan et al (ref. [7])

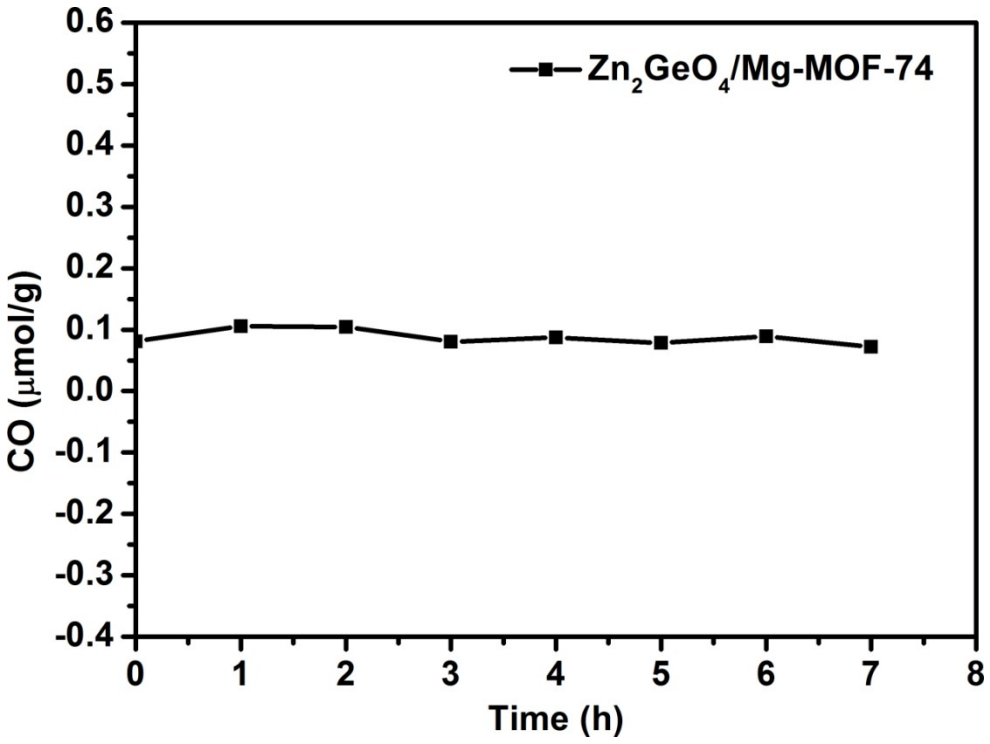

Fig. S3. Time-production plot of CO produced from the Zn_2GeO_4 and Mg-

MOF-74 complex substance using N_2 instead of CO_2. Reaction conditions: solvent (2ml, MeCN : H_2O = 4:1), N_2 (1 atm), 1100nm ≥ n ≥ 200 nm, room temperature , 7h.

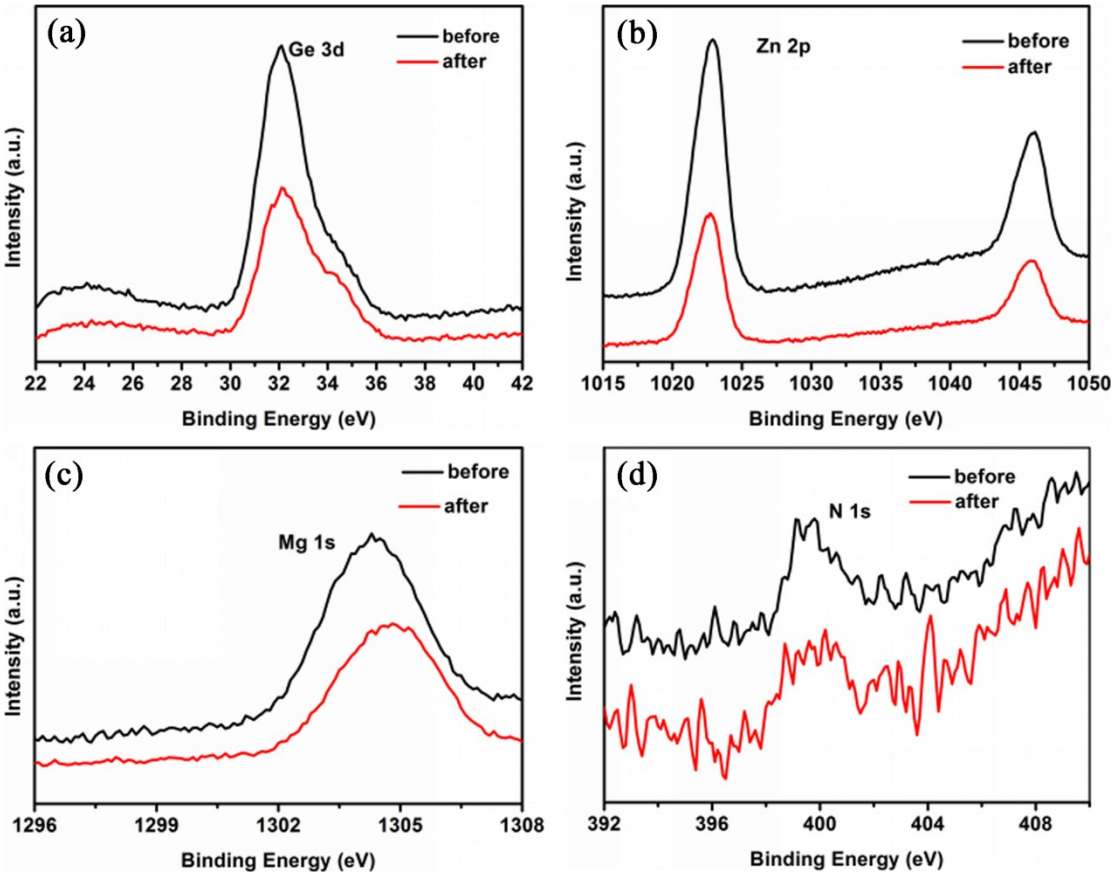

Fig. S4. High-resolution XPS spectra of the prepared samples: (a) Ge 3d ; (b) Zn 2p; (c) Mg 1s and (d) N 1s.

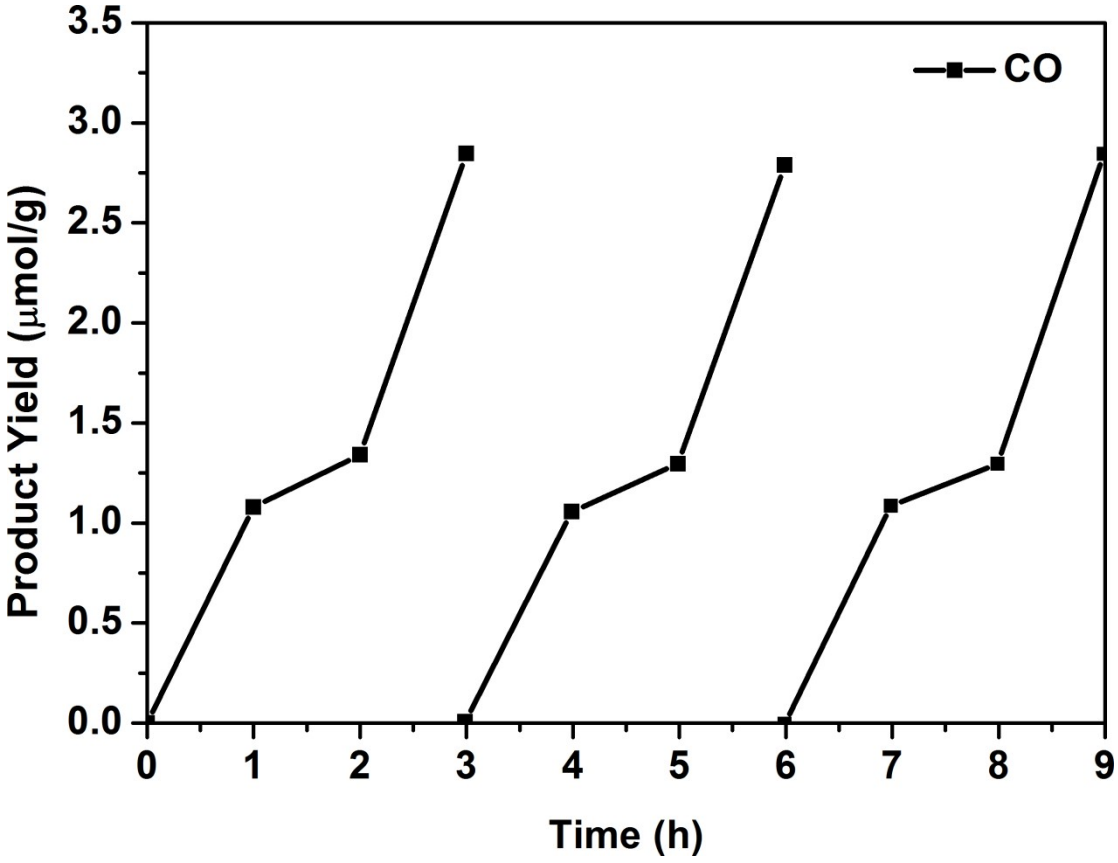

Fig. S5. Stability experiment of the Zn_2GeO_4/Mg-MOF-74 catalysts. Reaction conditions: solvent - 2 ml, MeCN : H_2O = 4:1; CO_2-1 atm; 1100 nm $\geqslant$ n $\geqslant$ 200 nm; room temperature; 9 h.

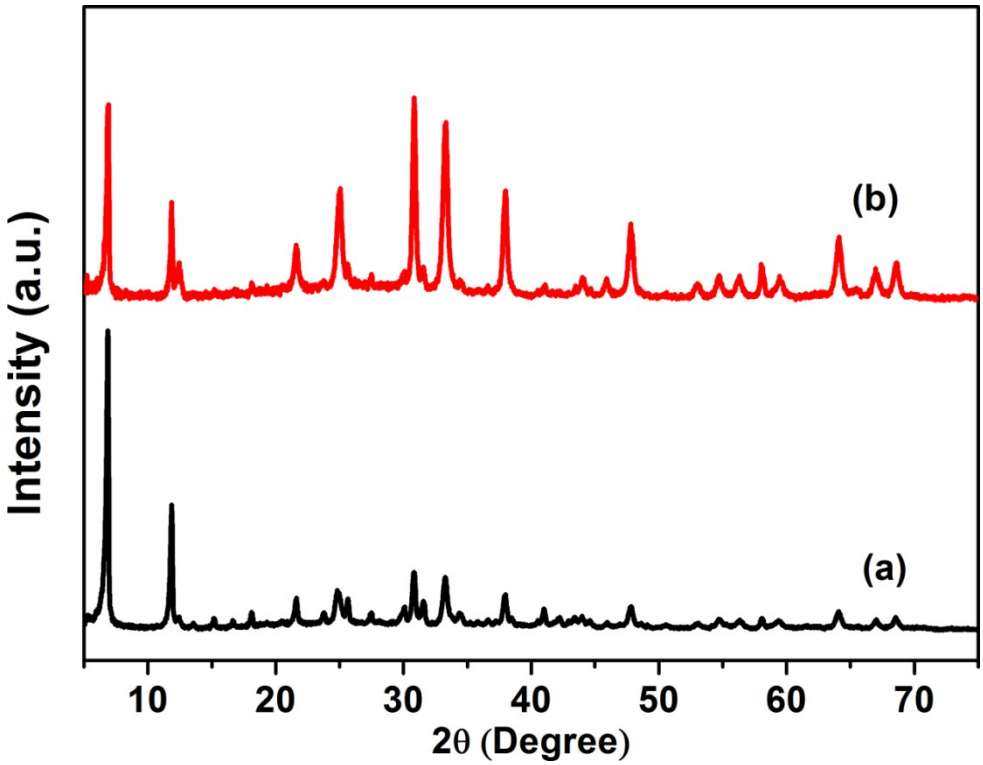

Fig. S6. PXRD patterns of Zn_2GeO_4/Mg-MOF-74 hybrid nanorods (a) before and (b) after the photocatalytic reaction.

References

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