Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Highly efficient photochemical CO_2 conversion to CO over Bi_2WO_6 hybridized with g-C_3N_4 under visible light

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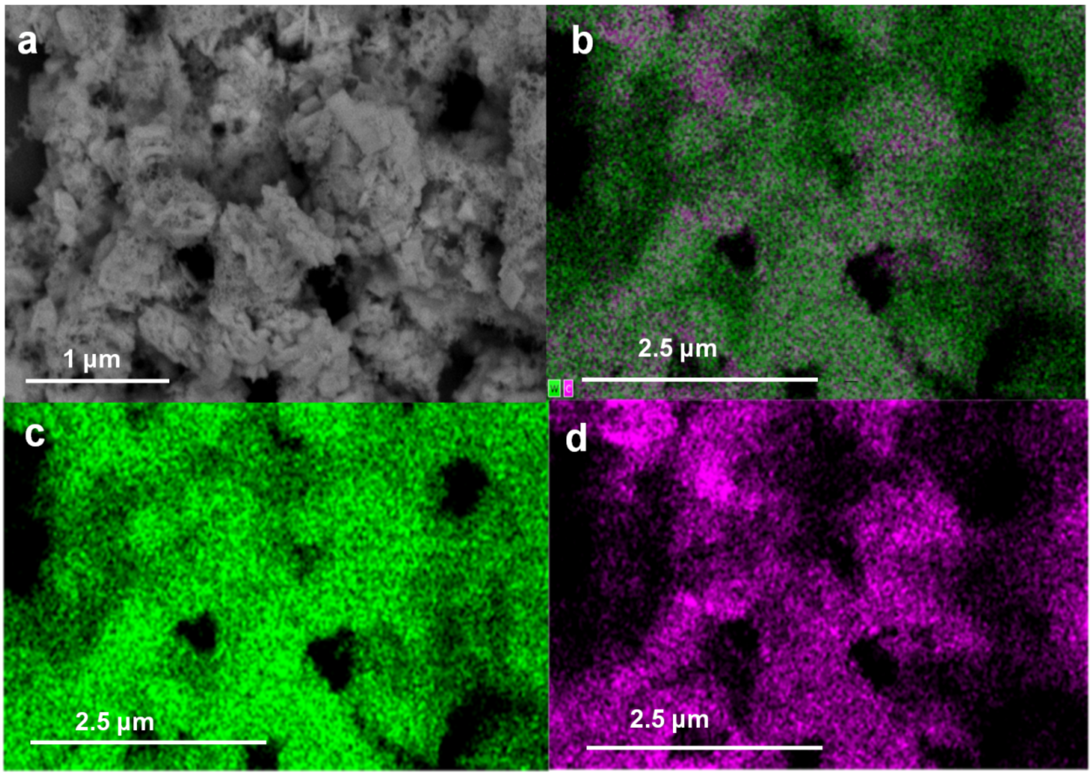

Figure S1. SEM image of the g-C_3N_4-0.1/Bi_2WO_6 (a) and the corresponding element mappings of the sample: merged W and C elements (b), W element and (d) C element

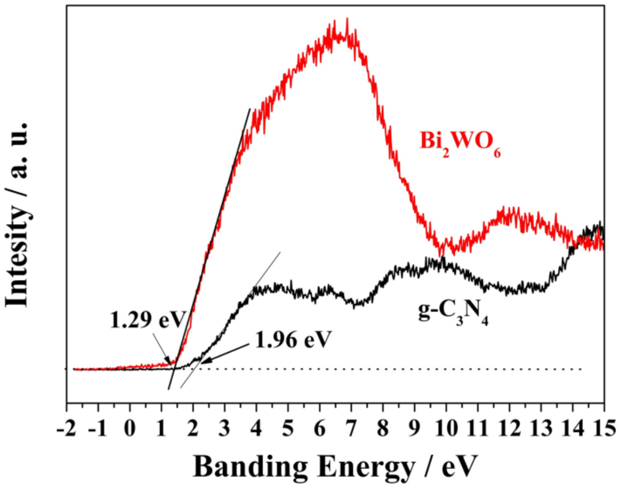

Figure S2 VB XPS of spectra of g-C_3N_4 and Bi_2WO_6 (solid lines: band position of pure g-C_3N_4 and Bi_2WO_6; dotted lines: estimated band position for the two samples)

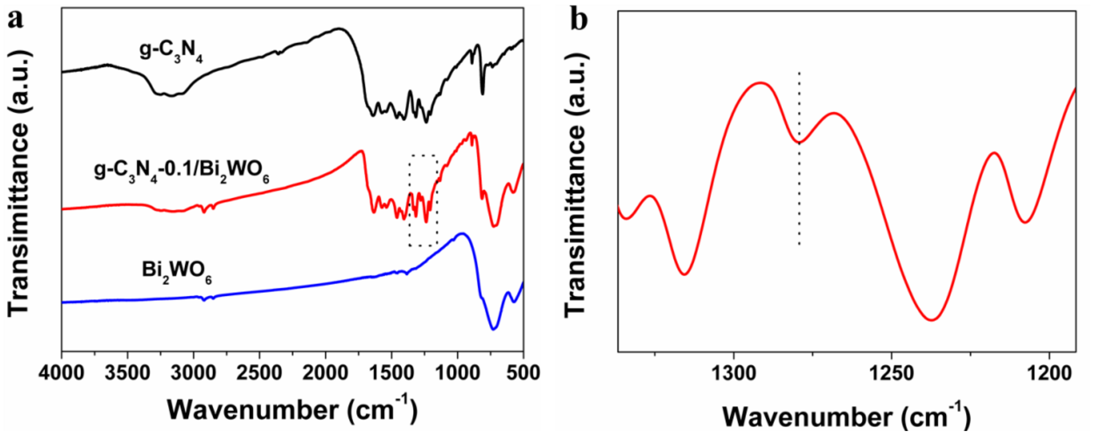

Figure S3 FT-IR spectra of g-C_3N_4, Bi_2WO_6 and g-C_3N_4-0.1/Bi_2WO_6 samples (a), expanded spectrum corresponding to the marked spectrum of g-C_3N_4-0.1/Bi_2WO_6.

The chemical structures of the heterojunctions were further studied by the FTIR spectra as shown in Figure S2. All characteristic absorption bands of g-C_3N_4 and Bi_2WO_6 appear in the spectra of g-C_3N_4-0.1/Bi_2WO_6, indicating the coexistence of the two semiconductors, which is consistent with the XRD results. The presence of new peak at 1280 cm^{-1} may due to the stretching mode of C-O-C bond.[1] For the g-C_3N_4 sample, the sharp peak at 807 cm^{-1} which is caused by the breathing vibration of s-triazine ring system was observed.[2] Besides, the broad peaks between 3500 cm^{-1} and 3000 cm^{-1} were originated from the N-H and O-H stretches.[3] Several typical absorption band in the second region of 1800-900 cm^{-1} are attributed to characteristic stretching vibration signals of the tri-s-triazine heterocyclic rings.[4]

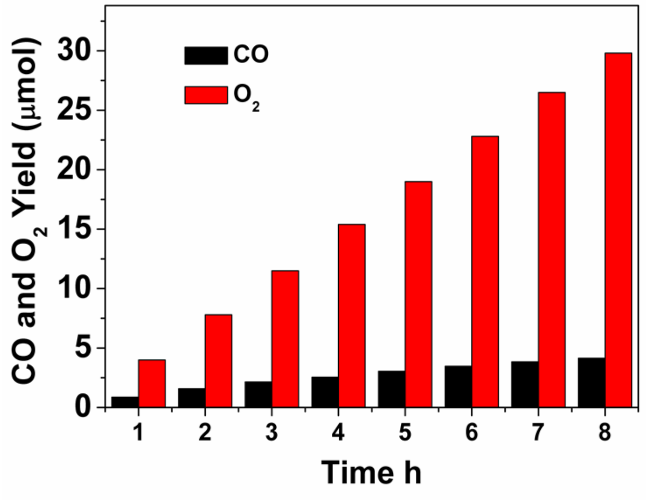

Figure S4. Time courses of photocatalytic CO and O_2 production over g-C_3N_4-0.1/Bi_2WO_6 under visible-light irradiation. Conditions: 0.1 g catalyst, reaction temperature, 25 °C, ambient pressure, 300 W Xe-lamp (λ>420 nm).

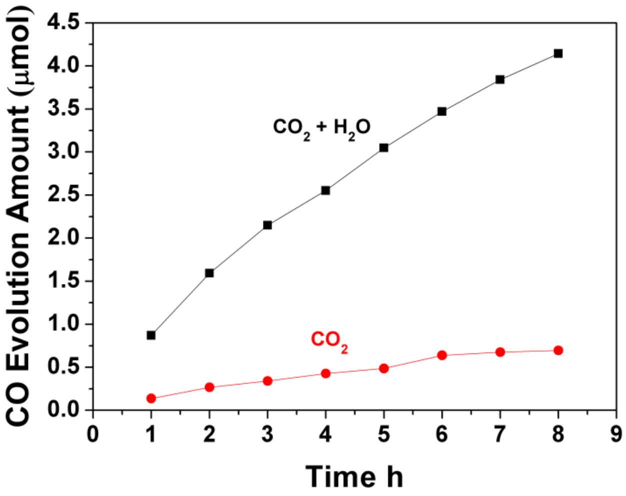

Figure S5. CO evolution on g-C_3N_4-0.1/Bi_2WO_6 samples with and without H_2O in feed gas for 8h under visible light rradiation

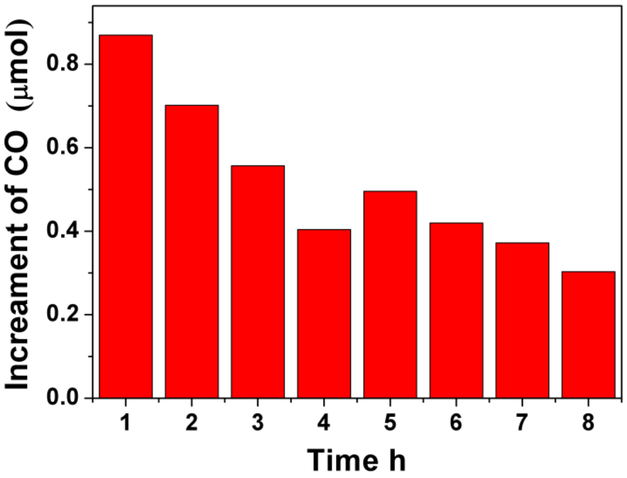

Figure S6. Time-dependent increasement of CO generation over g-C_3N_4-0.1/Bi_2WO_6 composites prepared at 160 °C, 18h.

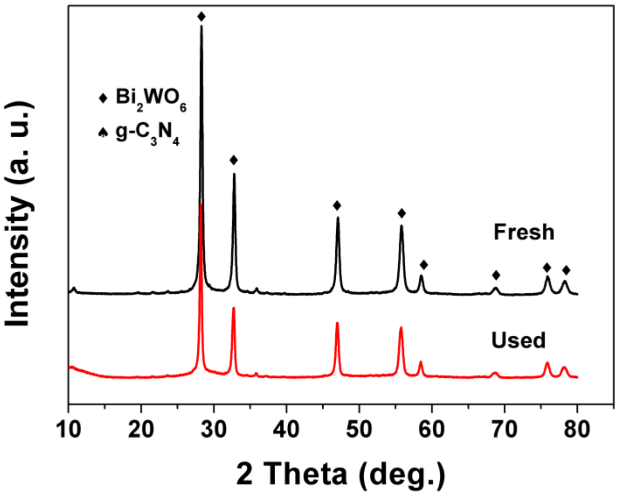

Figure S7. XRD patterns of $g\text{-}C_3N_4\text{-}0.1/Bi_2WO_6$ samples (used and fresh)

$$CO_2 + 2H^+ + 2e^- \longrightarrow HCOOH \qquad E^0_{redox} = -0.61\ V \quad (R1)$$

$$CO_2 + 2H^+ + 2e^- \longrightarrow CO + H_2O \qquad E^0_{redox} = -0.53\ V \quad (R2)$$

$$CO_2 + 2H^+ + 2e^- \longrightarrow HCHO + H_2O \qquad E^0_{redox} = -0.48\ V \quad (R3)$$

$$CO_2 + 2H^+ + 2e^- \longrightarrow CH_3OH + H_2O \qquad E^0_{redox} = -0.38\ V \quad (R4)$$

$$CO_2 + 8H^+ + 8e^- \longrightarrow CH_4 + 2H_2O \qquad E^0_{redox} = -0.24\ V \quad (R5)$$

$$2H^+ + 2e^- \longrightarrow H_2 \qquad E^0_{redox} = -0.41\ V \quad (R6)$$

Scheme S1. Equations of the electeochemical CO_2 reduction potentials versus the NHE at pH 7[5]

1. J. A. Dean, *Lange's Chemistry Hadbook Version 13th*, 1991, 1464.
2. Y. Li, J. Zhang, Q. Wang, Y. Jin, D. Huang, Q. Cui, and G. Zou, *J. Phys. Chem. B*, 2010, **114**, 9429-9434.
3. P. Niu, L. Zhang, G. Liu, and H. Cheng, *Adv. Func. Mater.*, 2012, **22**, 4763-4770.
4. Q. Xiang, J. Yu and M. Jaroniec, *J. Phys. Chem. C*, 2011, **115**, 7355-7363.
5. S. Habisreutinger, L. Schmidt-Mende and J. Stolarczyk, *Angew. Chem. Int. Ed.*, 2013, **52**, 7372-7408.