Supplementary Material

Self-Z-Scheme Plasmonic Tungsten Oxides Nanowires Boosting Ethanol Dehydrogenation under UV-Visible Light Irradiation

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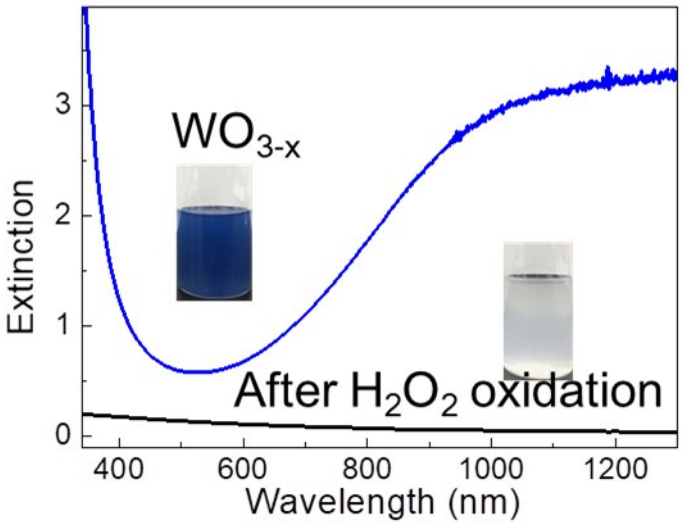

Fig. S1. Extinction spectra of plasmonic WO_{3-x} nanowire before and after H_2O_2 oxidation, and their solution color

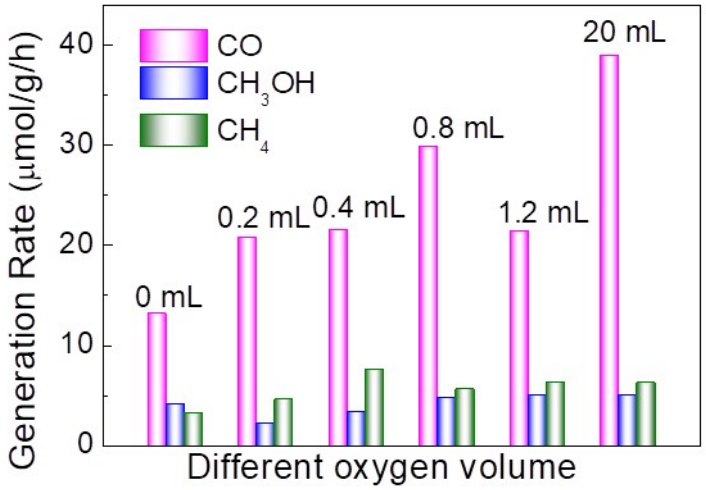

Fig. S2. Inflence of oxygen on C1 compounds generation over plasmonic WO_{3-x} as photocatalysts under UV-visible light irradiation.

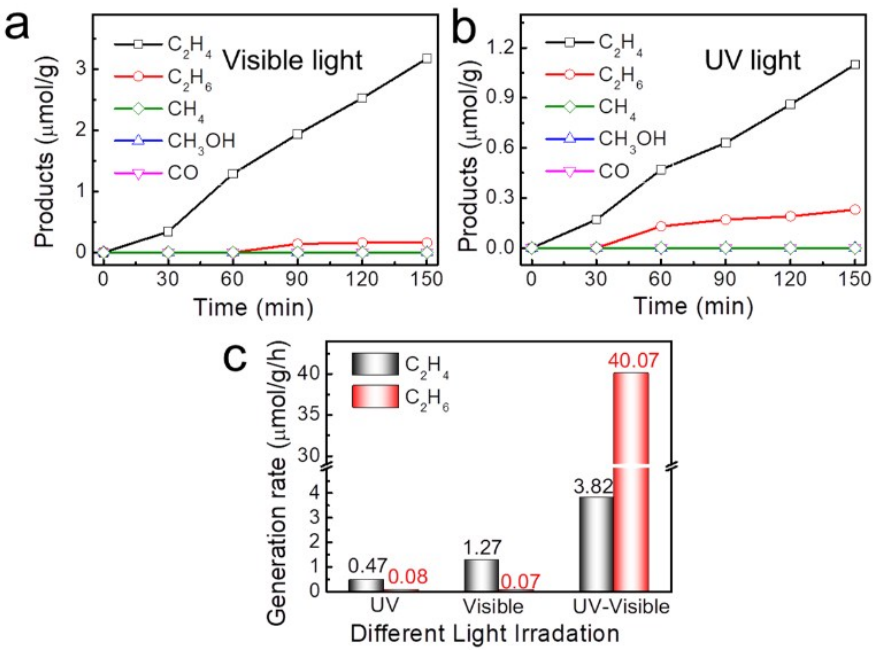

Fig. S3 . Products generation over plasmonic WO_{3-x} nanowire in nitrogen under visible (a), UV (b) and UV-visible, respectively. Ethylene and ethane generation rates (c) over plasmonic WO_{3-x} nanowire in nitrogen under visible, UV and UV-visible light irradiation, respectively.

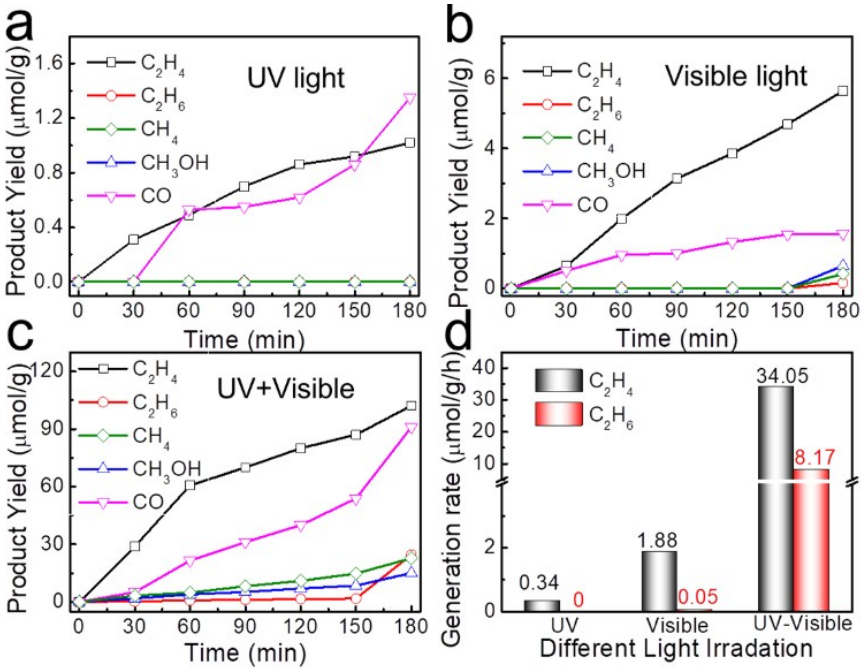

Fig. S4. Products generation over plasmonic WO_{3-x} nanowire in optimal oxygen (0.4 mL) under UV (a), visible (b) and UV-visible (c) light irradiation, respectively. Ethylene and ethane generation rates (d) over plasmonic WO_{3-x} nanowire in optimal oxygen (0.4 mL) under visible, UV and UV-visible light irradiation, respectively.

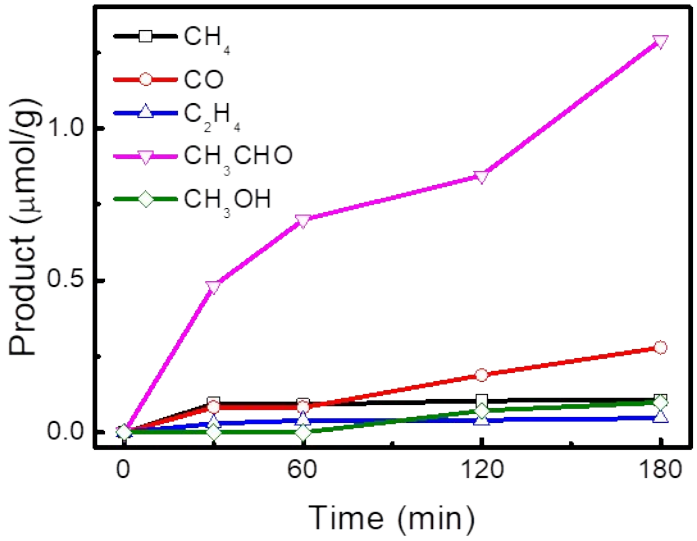

Fig. S5. Products of methanol dehydrogenation reaction with absence of plasmonic WO_{3-x} under UV-visible light irradation.

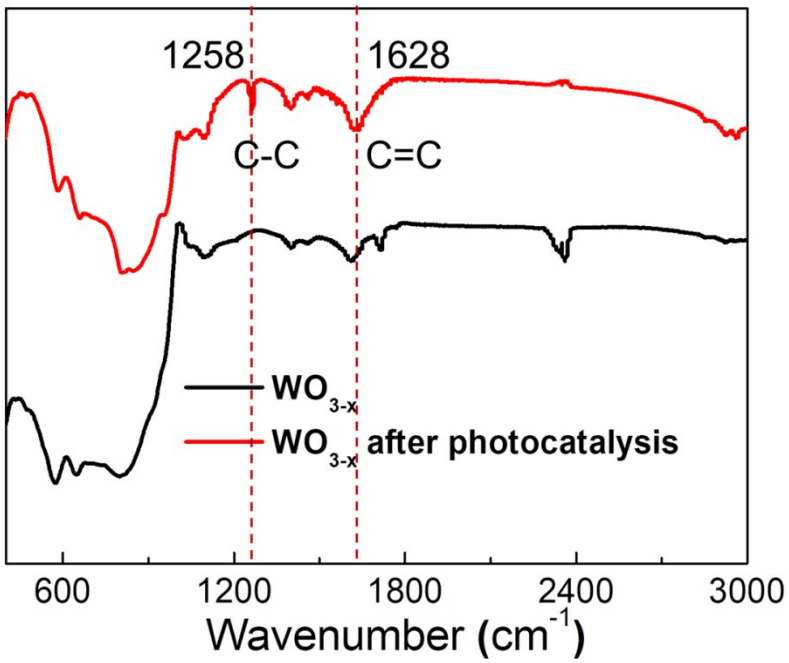

Fig. S6. IR spectra of plasmonic WO_{3-x} before and after photocatalysis.

Catalysts	T (K)	Products	Conversion (%)	Selectivity (%)	Byproducts	Ref.
$Cu/C/SiO_2$	533	acetaldehyde	83.0	95.1	ethyl acetate, butanal, butanol	[1]
Cu/SiO_2	533	acetaldehyde	85.4	79.4	ethyl acetate, butanal, butanol	[1]
MoO_2	573	acetaldehyde, ethane	42.9	47.1, 45.6	ethylene	[2]
Cu/MC	553	acetaldehyde	73.0	94	ethyl acetate, acetone, acetone	[3]
$Vo_x/TiO_2/SiO_2$	333	acetaldehyde	66.0	99	ethylene, carbon dioxide	[4]
Pt/TiO_2	333	acetaldehyde	69.0	90	ethylene, carbon dioxide crotonaldehyde	[5]
WO_{3-x}	**303**	**acetaldehyde**	**84.2**	**91**	**ethylene, carbon monoxides**	**This work**

Table. S1 Comparison of the catalytic performance over WO_{3-x} with the reported catalysts for the ethanol dehydrogenation

References

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[2] Y. Nakamura, T. Murayama, W. Ueda, *ChemCatChem* , **2014**, 6, 741-744.

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