Electronic Supplementary Information

Photothermal-coupled solar photocatalytic CO_2 reduction with high efficiency and selectivity on MoO_{3-x}@$ZnIn_2S_4$ core-shell S-scheme heterojunction

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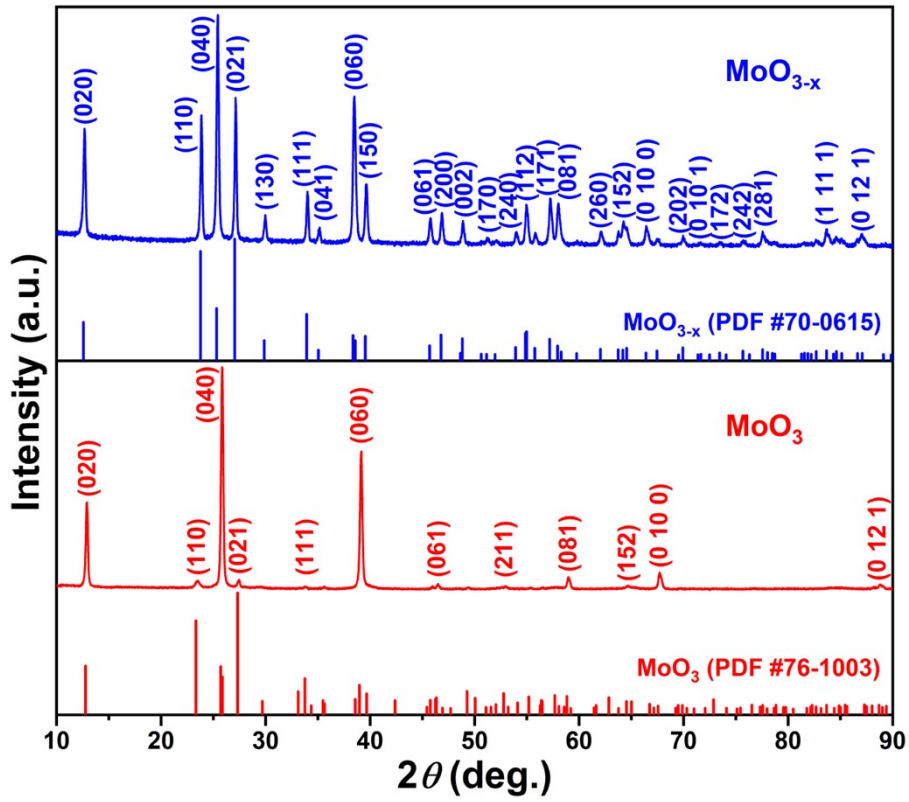

Fig. S1 XRD patterns of the prepared MoO_{3-x} and MoO_3 samples.

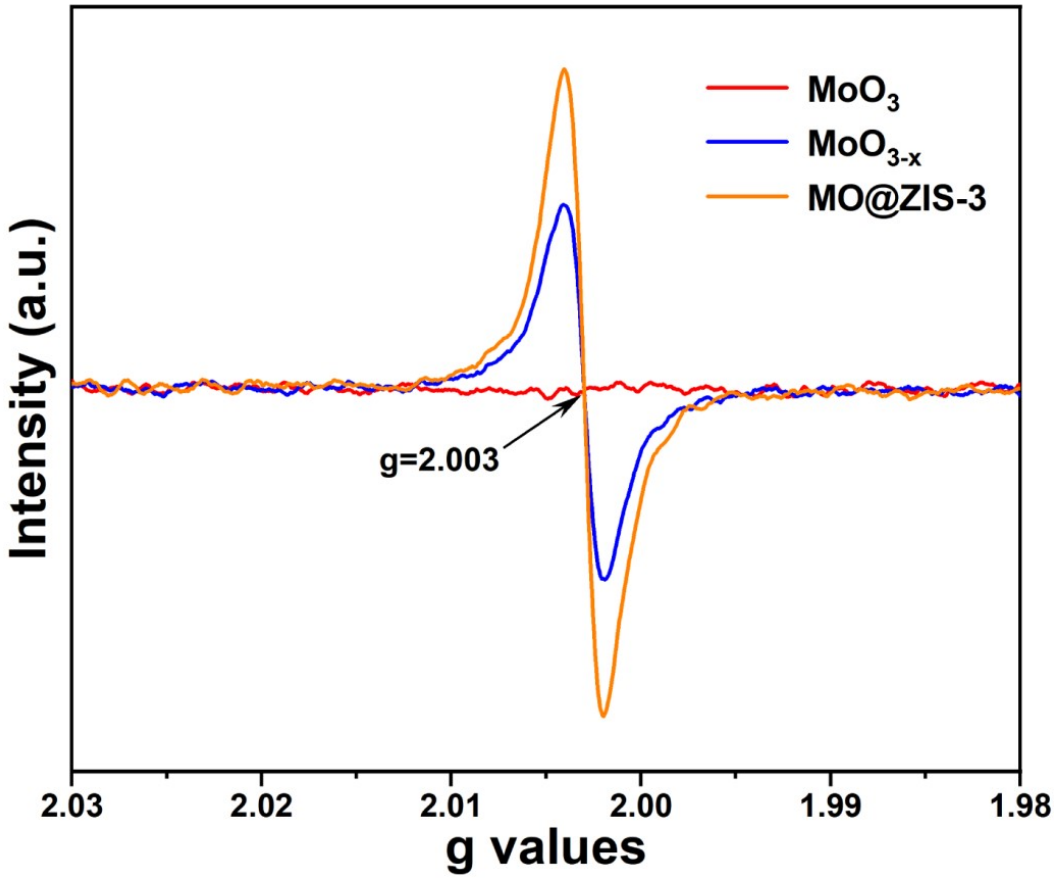

Fig. S2 EPR spectra of the prepared $MoO_{3-x,}$ MoO_3 and MO@ZIS-3 samples.

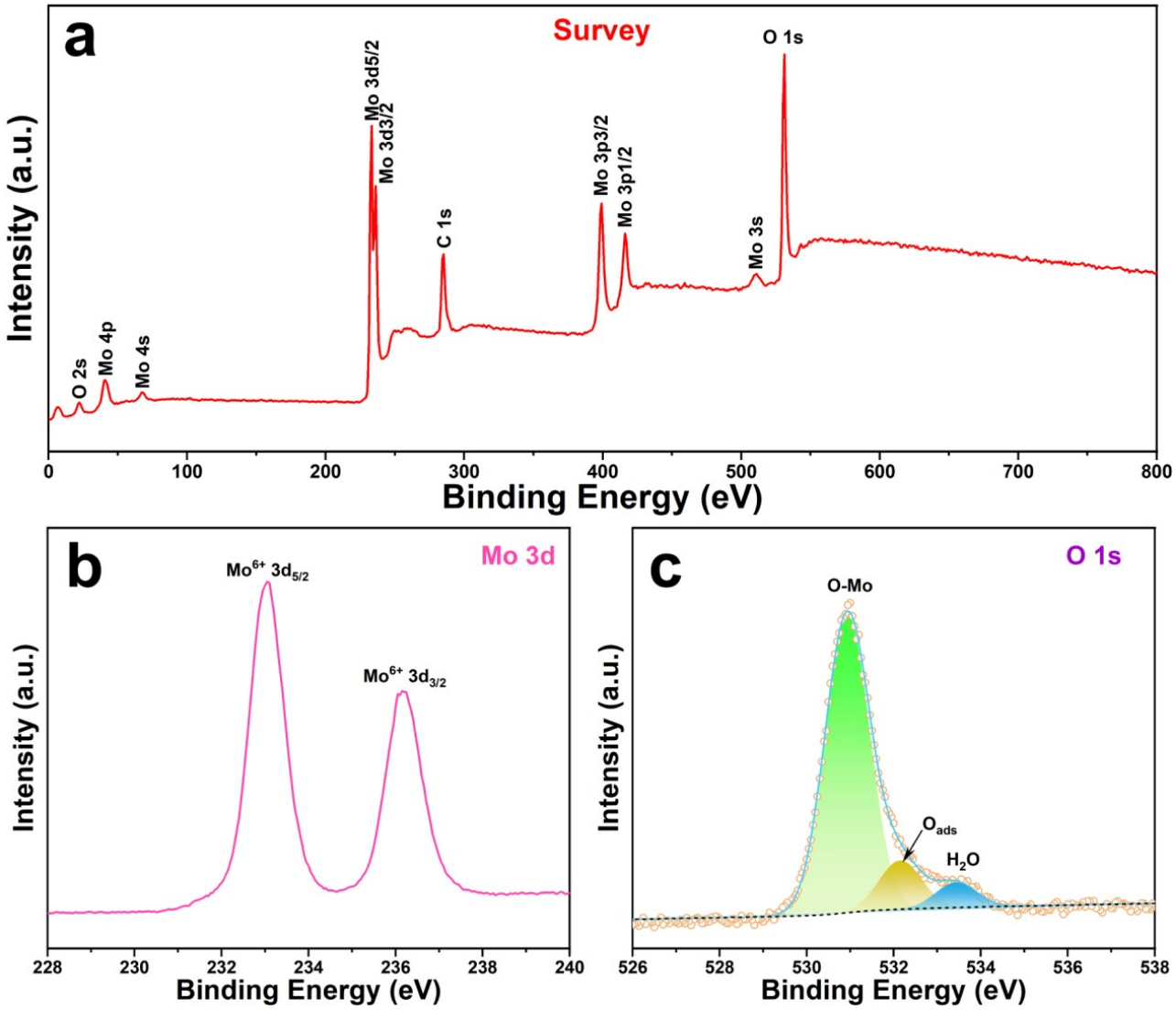

Fig. S3 XPS spectra of the prepared MoO_3 sample: (a) the XPS survey spectrum, and the XPS core-level spectra of (b) Mo 3*d* and (c) O 1*s*.

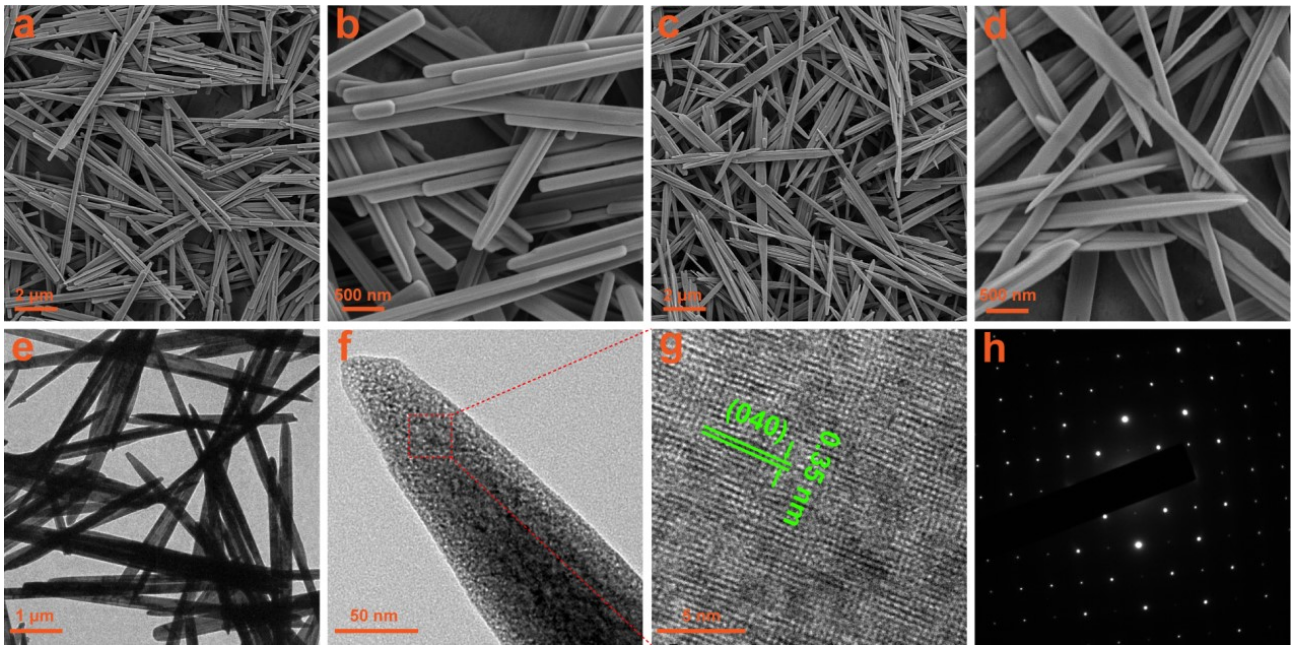

Fig. S4 (a-b) SEM images of the prepared MoO_3 sample. (c-d) SEM images, (e-f) TEM images, (g) HRTEM image, and (h) SAED patterns of the prepared MoO_{3-x} sample.

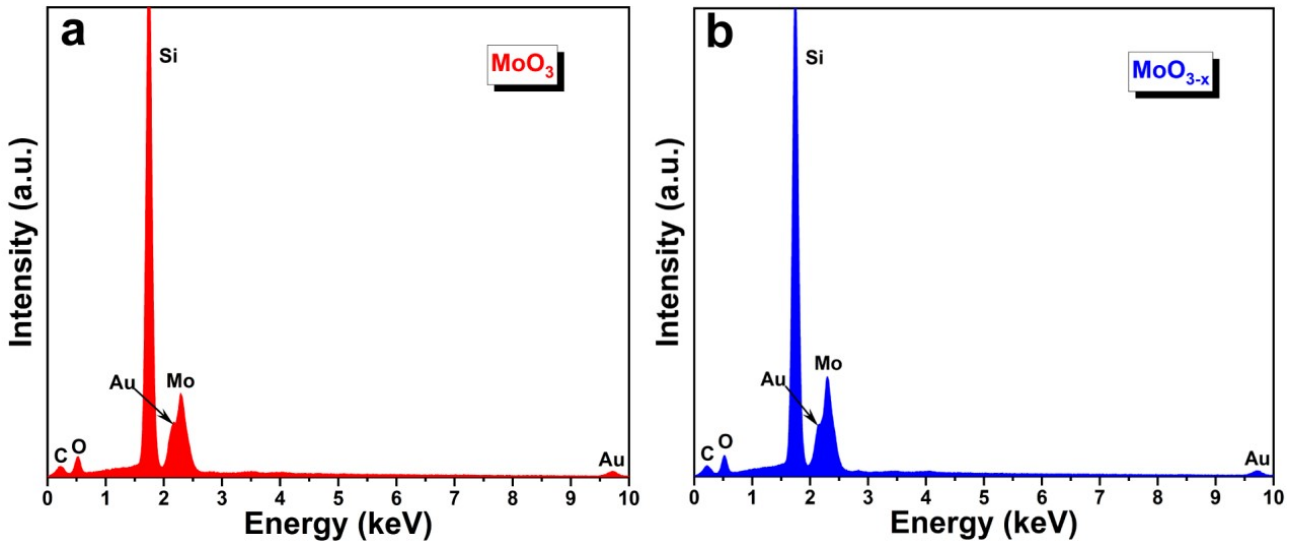

Fig. S5 EDS spectra of the prepared (a) MoO_3 and (b) MoO_{3-x} samples.

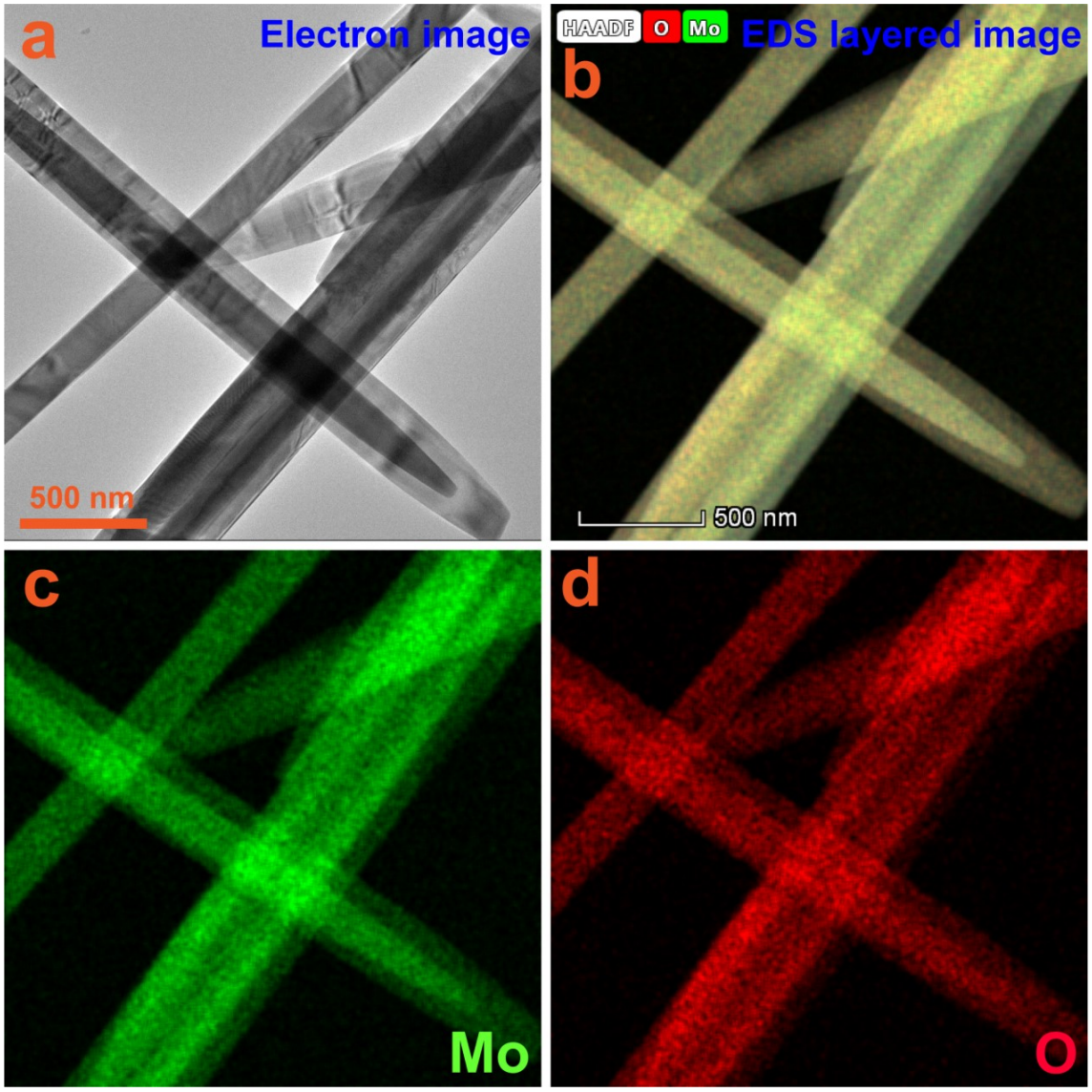

Fig. S6 (a) Electron image, (b) EDS layered image, and the corresponding EDS elemental mapping images of (c) Mo and (d) O of the prepared MoO_{3-x} sample.

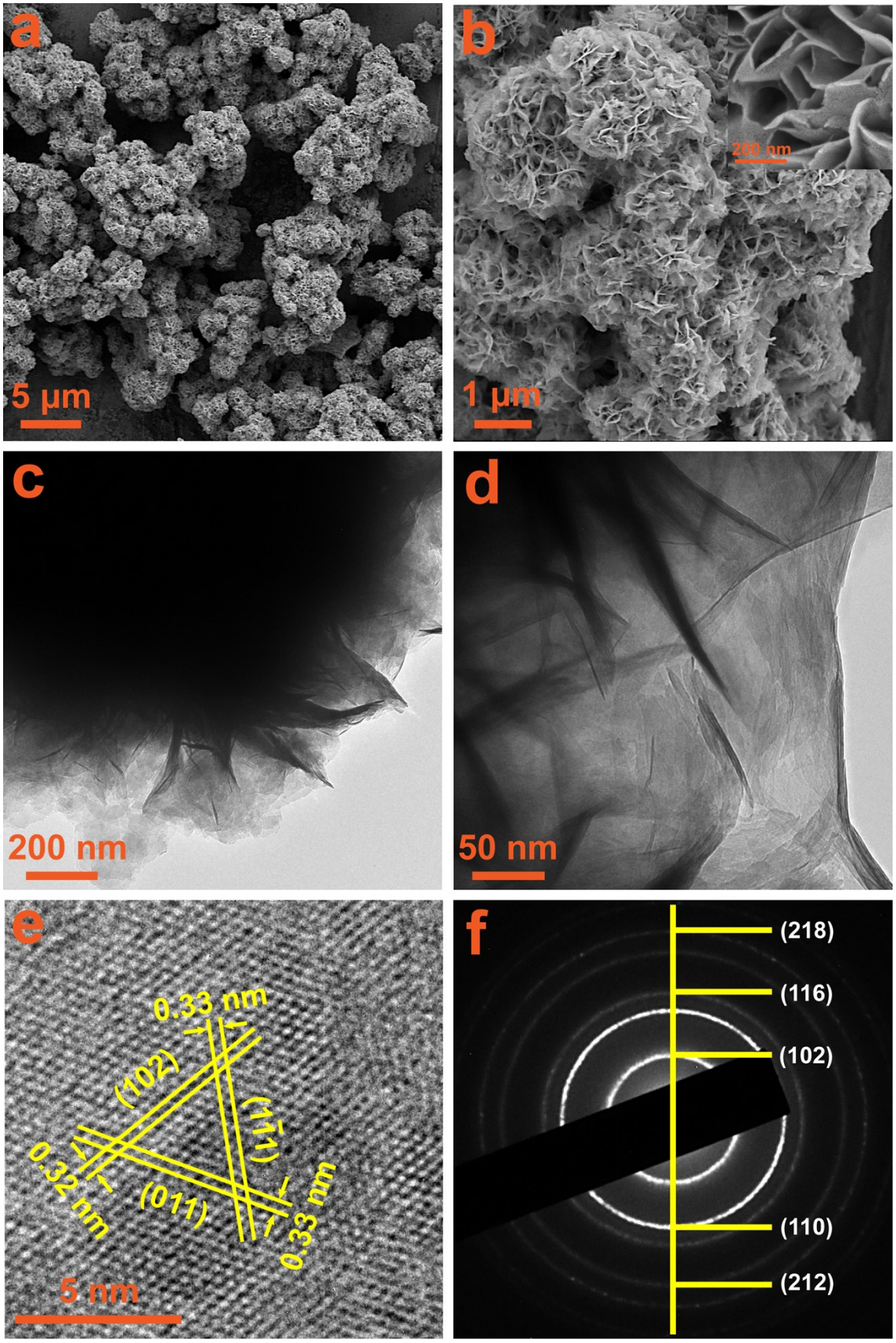

Fig. S7 (a-b) SEM images, (c-d) TEM images, (e) HRTEM image, and (f) SAED patterns of the prepared $ZnIn_2S_4$ sample.

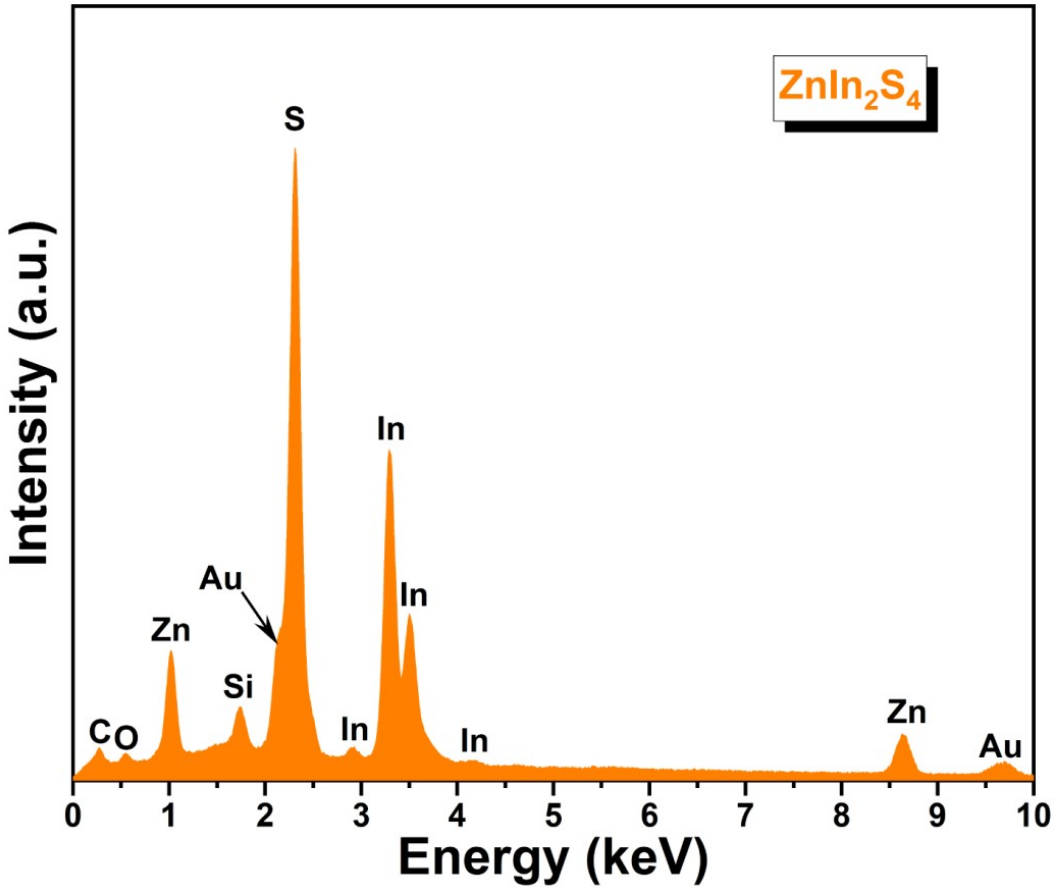

Fig. S8 EDS spectrum of the prepared $ZnIn_2S_4$ sample.

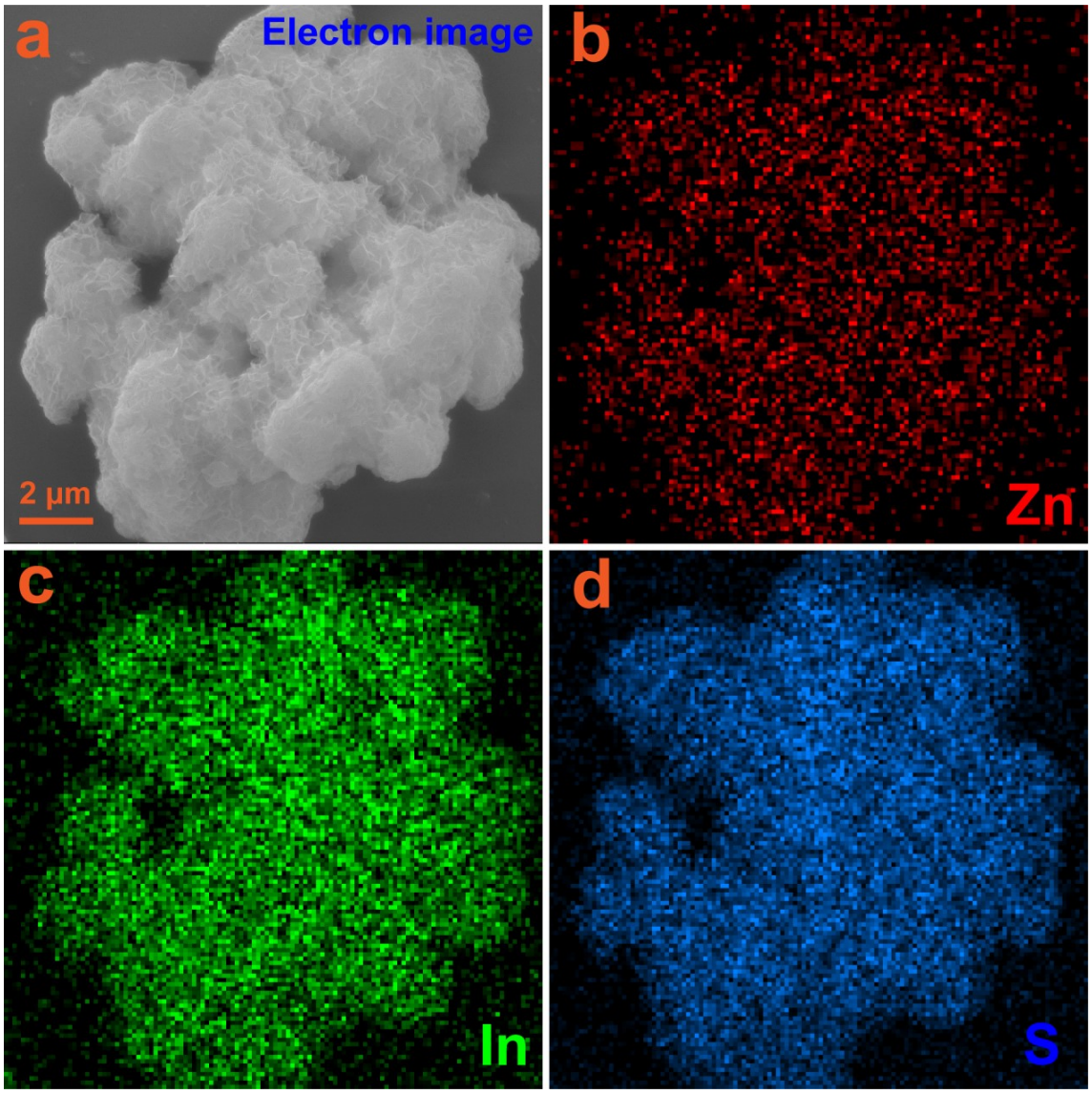

Fig. S9 (a) Electron image, and the corresponding EDS elemental mapping images of (b) Zn, (c) In, and (d) S of the prepared $ZnIn_2S_4$ sample.

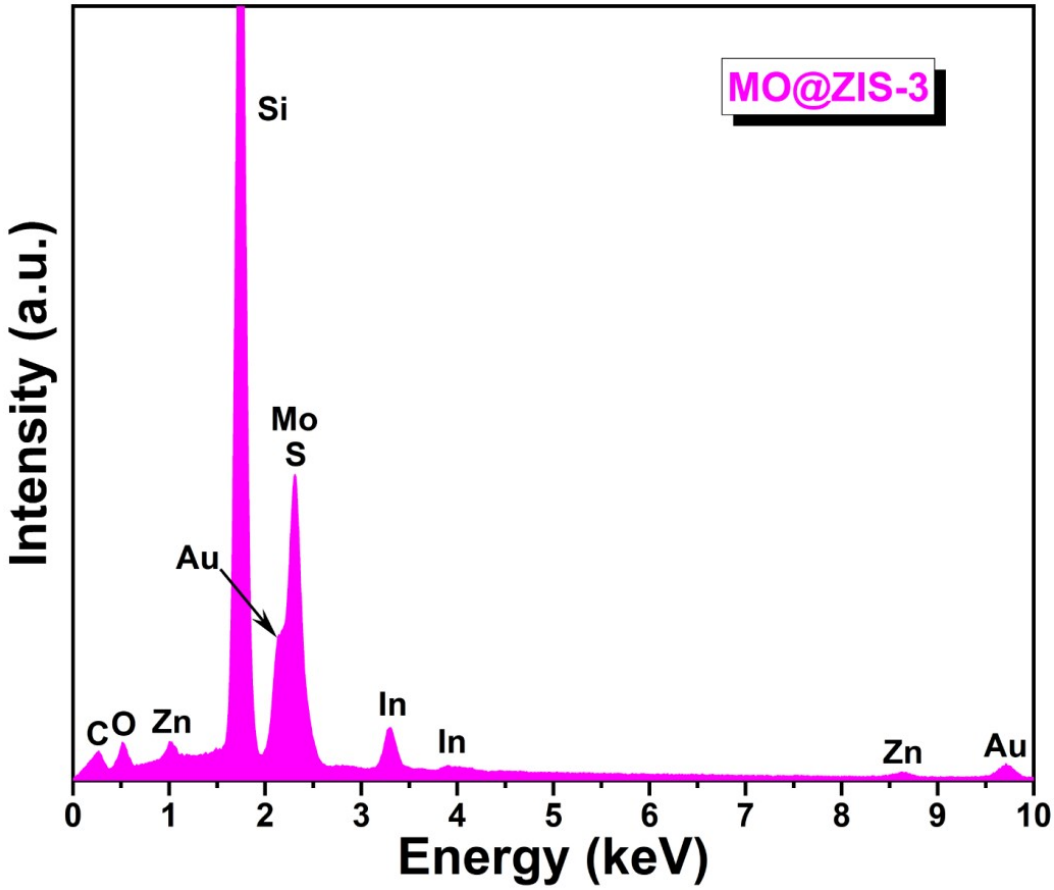

Fig. S10 EDS spectrum of the prepared MO@ZIS-3 sample.

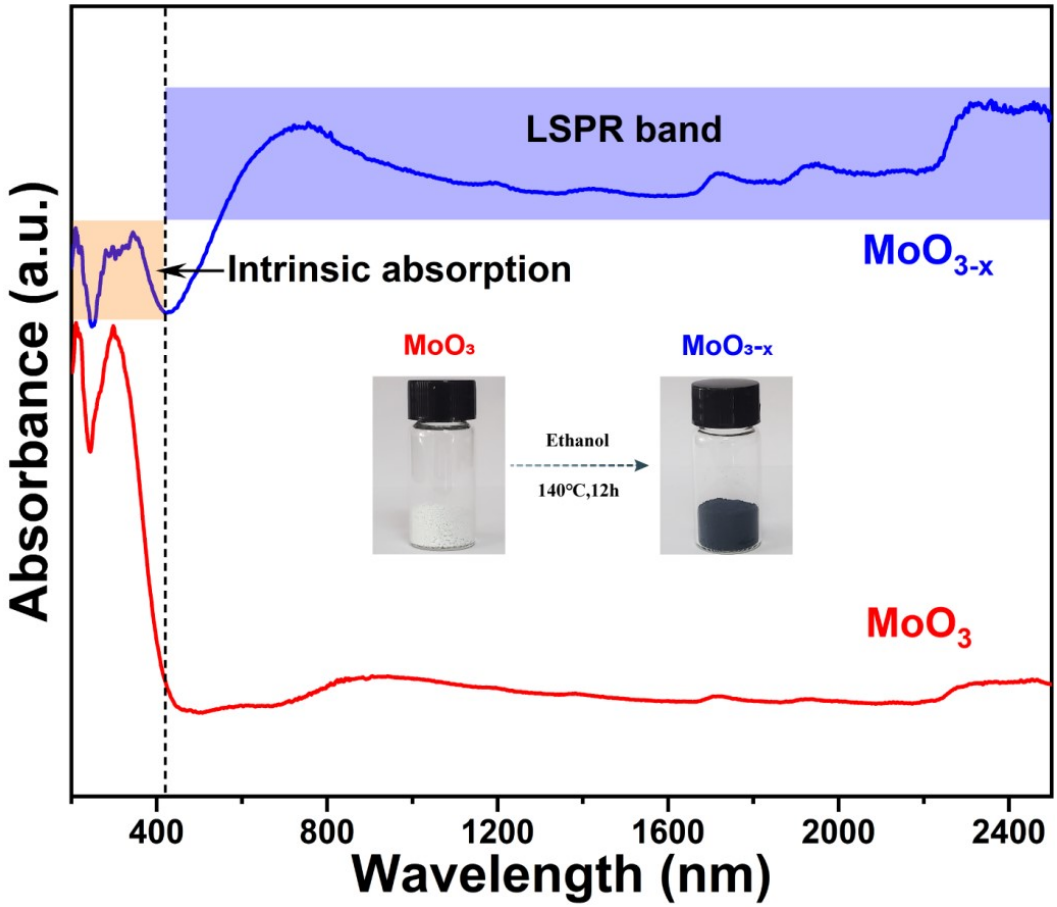

Fig. S11 UV-Vis-NIR absorption spectra of the prepared MoO_{3-x} and MoO_3 samples.

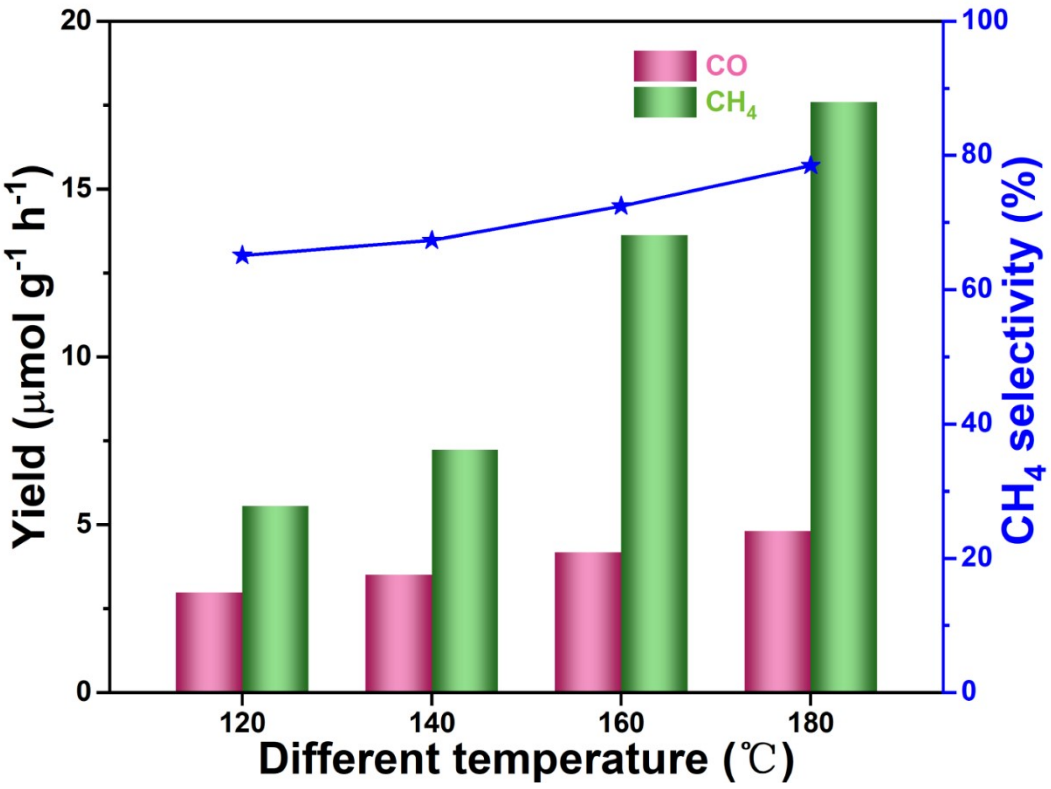

Fig. S12 Product yields and CH_4 selectivity of the prepared MO@ZIS-3 photocatalyst under different temperatures.

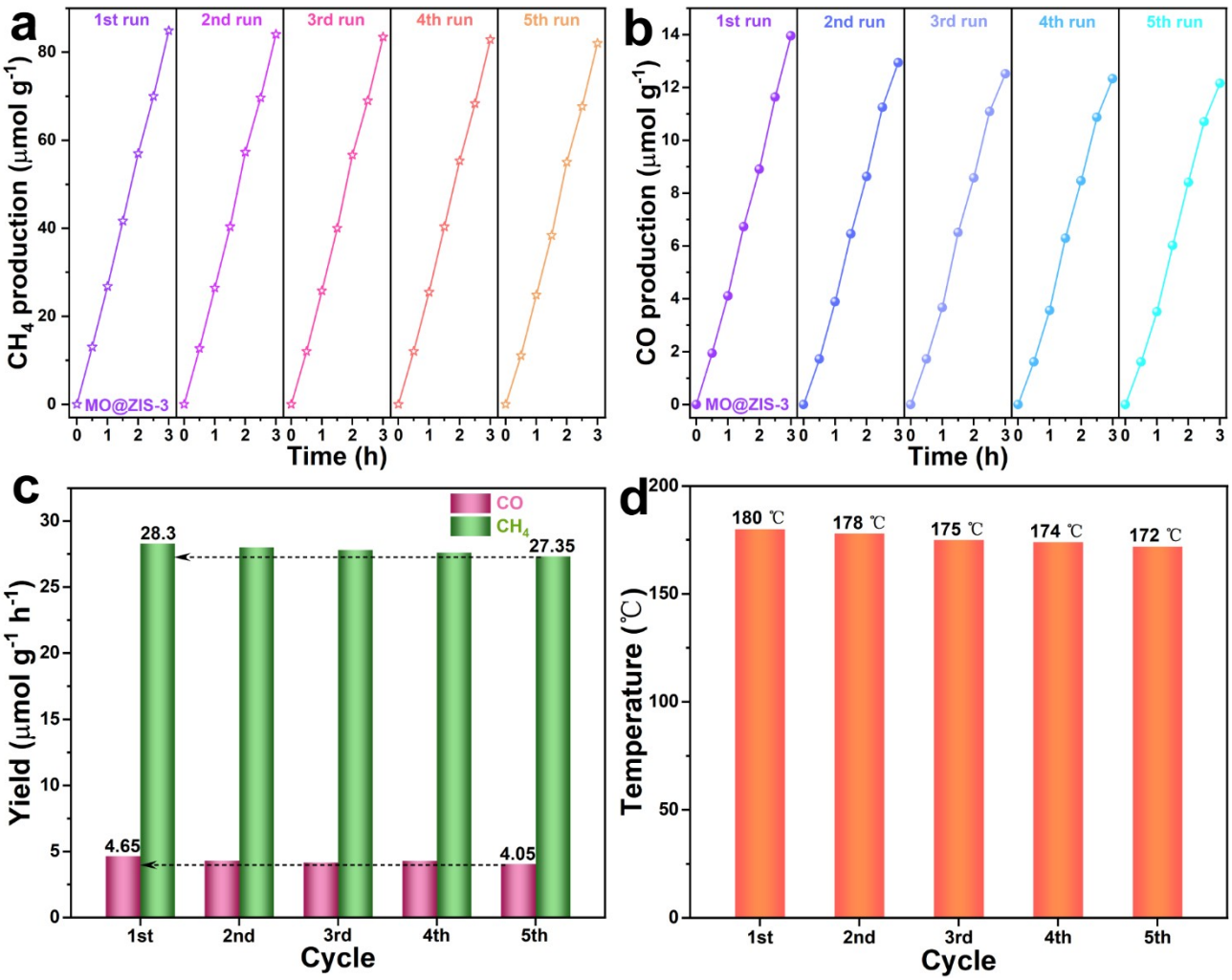

Fig. S13 (a) CH_4 production and (b) CO production as a function of irradiation time under full-spectrum illumination for the prepared MO@ZIS-3 photocatalyst over five runs of cycling tests. (c) Product yields and (d) the corresponding catalyst surface temperatures during the five cycles of tests.

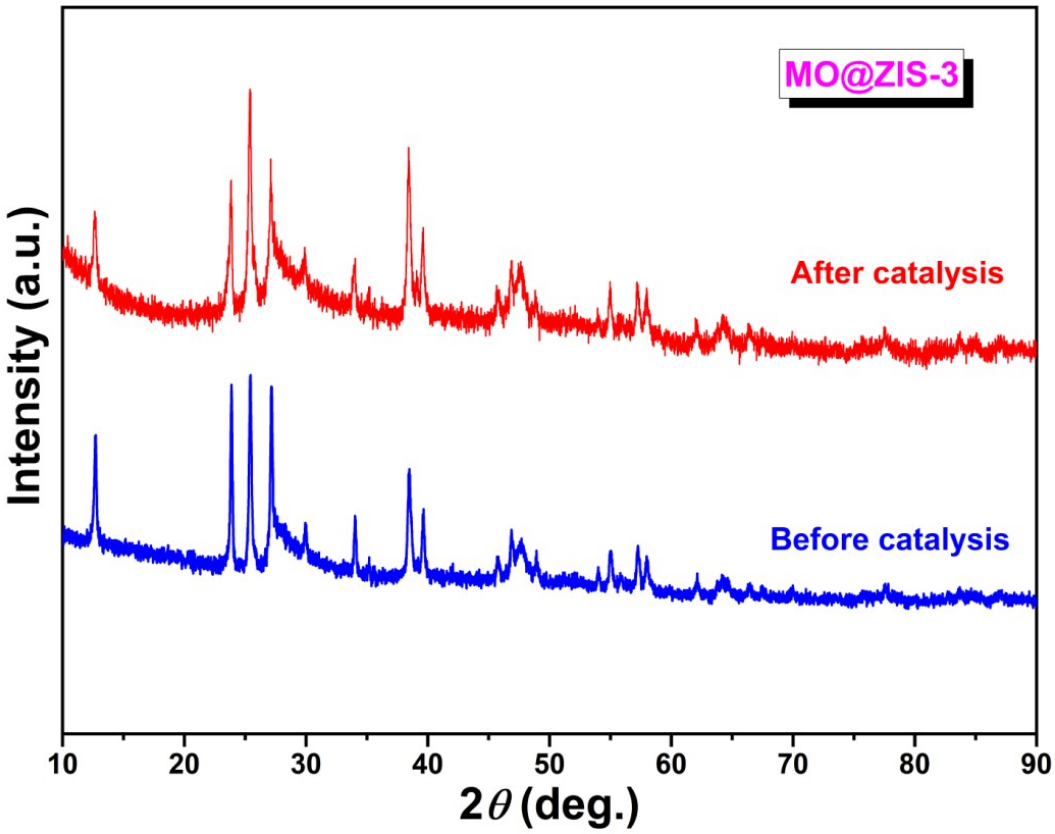

Fig. S14 XRD patterns of the MO@ZIS-3 catalyst before and after five runs of photocatalytic CO_2 reduction.

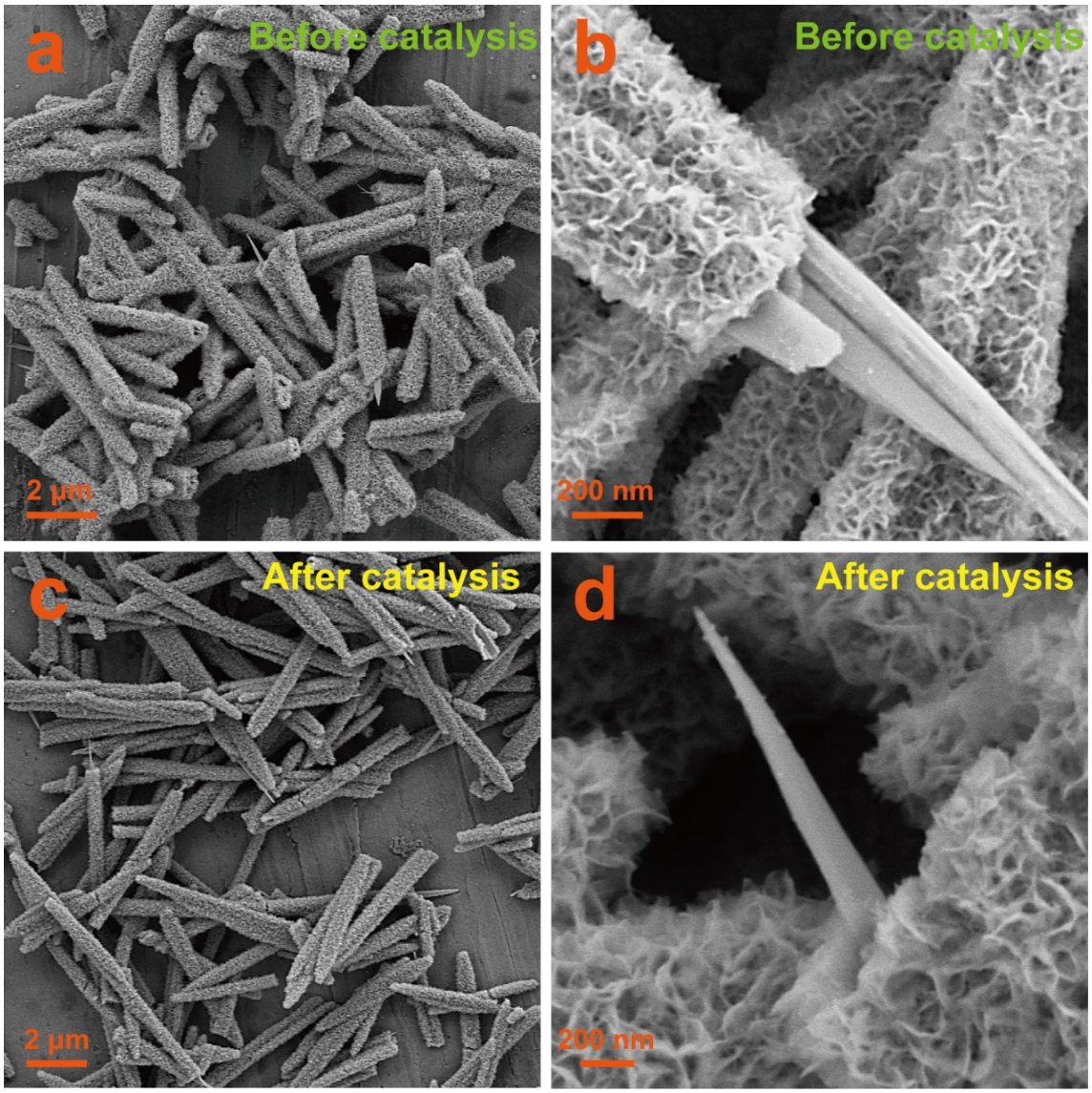

Fig. S15 SEM images of (a-b) the pristine MO@ZIS-3 photocatalyst and (c-d) that after five runs of photocatalytic CO_2 reduction.

Table S1 Contents of Zn, In and S elements in the MO@ZIS-3 catalyst before and after five cycles of photocatalytic experiments.

Sample	Zinc element content (wt %)	Indium element content (wt %)	Sulfur element content (wt %)
Before catalysis	6.15	21.81	12.20
After catalysis	6.06	21.49	12.01

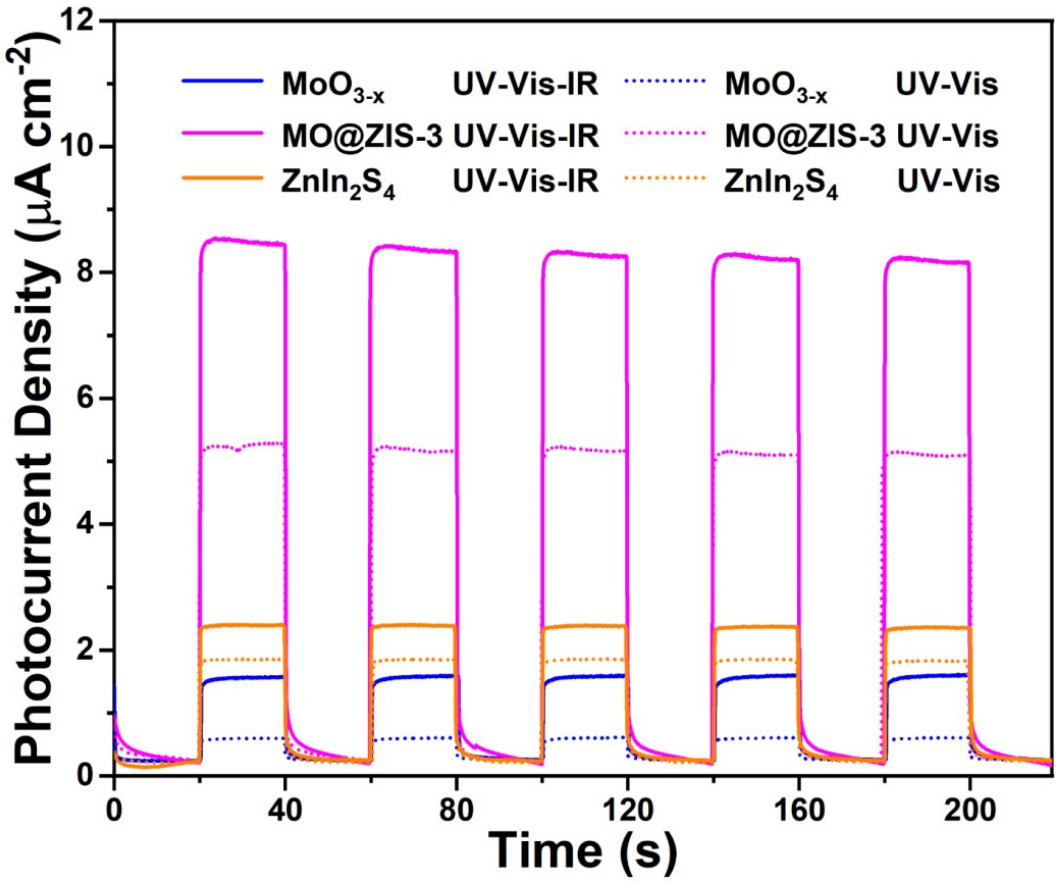

Fig. S16 Transient photocurrent responses of the prepared MoO_{3-x}, MO@ZIS-3 and $ZnIn_2S_4$ samples under UV-Vis and UV-Vis-IR illumination.