Supporting Information

Facilitating space charge directional separation for enhancing photocatalytic CO_2 reduction over tetragonal $BiVO_4$

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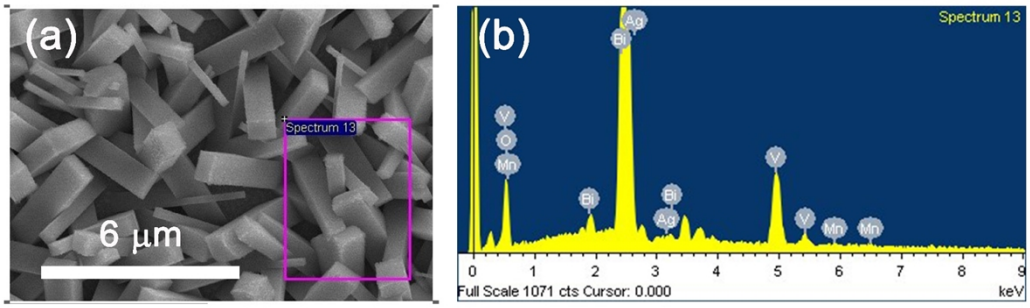

Fig. S1 Energy Dispersive Spectrometer (EDS) spectra of Ag-MnO_x-BVO sample.

Table S1 The detailed information about the composition of Ag-MnO_x-BVO sample.

Element	Atomic%
O K	62.15
V K	17.02
Mn K	0.42
Ag L	0.55
Bi M	19.86
Totals	100

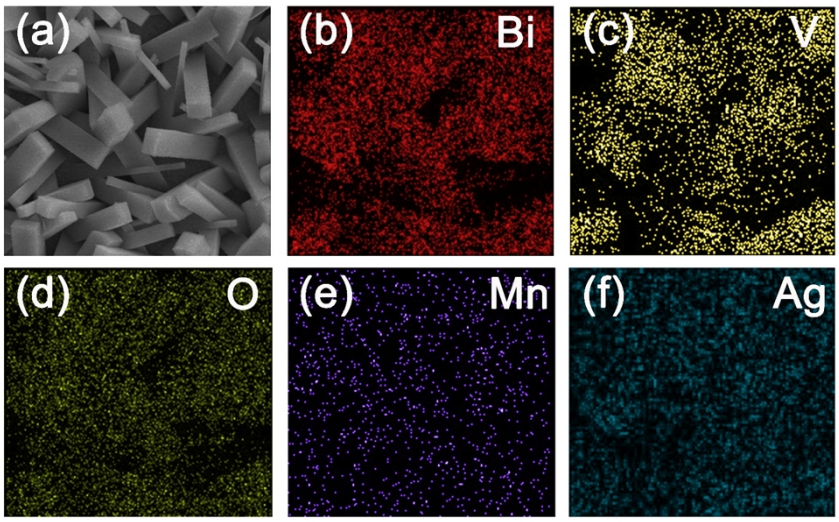

Fig. S2 Mapping spectra of Ag-MnO_x-BVO sample based on the selected region of Fig. S1a.

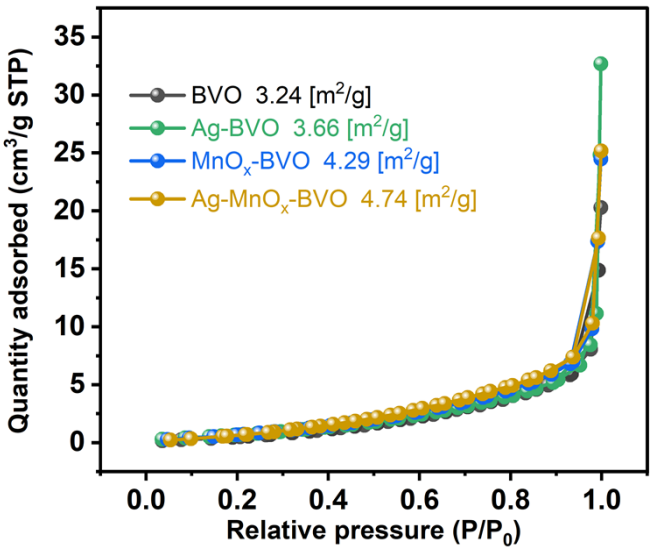

Fig. S3 N_2 adsorption-desorption isotherms of BVO, Ag-BVO, MnO_x-BVO and Ag-MnO_x-BVO samples.

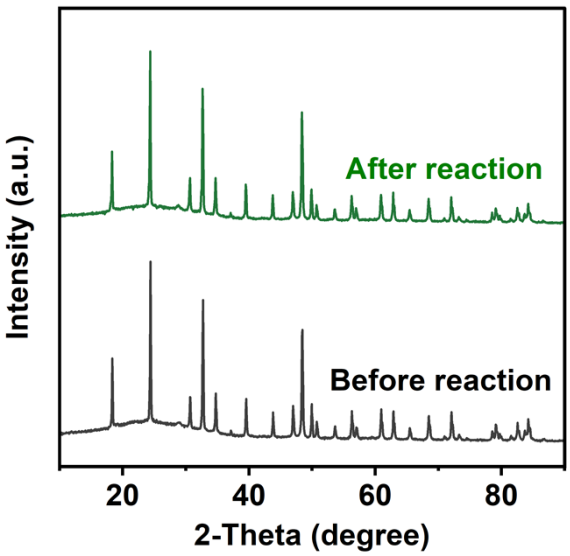

Fig. S4 XRD patterns of Ag-MnO_x-BVO sample before and after CO_2 reduction reaction.

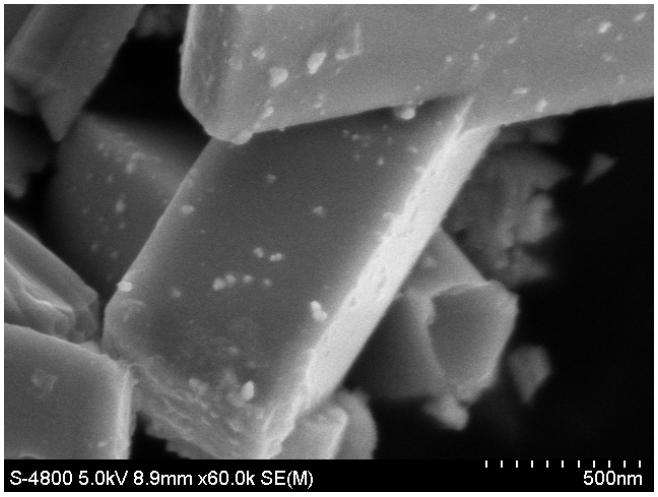

Fig. S5 SEM image of Ag-MnO_x-BVO sample after CO_2 reduction reaction.

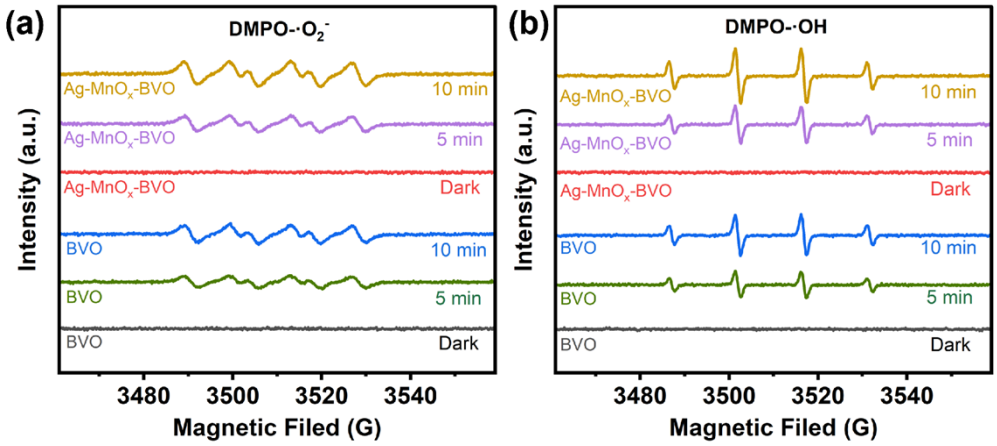

Fig. S6 ESR signals of DMPO-•O_2^- and DMPO-•OH over BVO and Ag-MnO_x-BVO under dark and irradiation (full spectrum), respectively.

Table S2. The fitting parameters of time-resolved photoluminescence spectra via three-exponential decay fitting.

Sample	τ_1 (ns)	τ_2 (ns)	τ_3 (ns)	A_1 (%)	A_2 (%)	A_3 (%)	$\tau_{average}$(ns)
BVO	0.3115	1.5244	5.1691	57.93	23.89	18.17	1.48
MnO_x-BVO	0.0159	1.3725	4.8224	39.61	53.91	6.48	1.06
Ag-BVO	0.0282	0.9728	4.1146	67.34	18.88	13.78	0.77
Ag-MnO_x-BVO	0.0382	1.0362	4.3521	77.23	12.81	9.96	0.60

Table S3. The ICP-OES measurement of Ag and Mn on Ag-BVO, MnO_x-BVO and Ag-MnO_x-BVO.

Catalyst sample	Ag loading (wt%)	Mn loading (wt%)
Ag-BVO	0.17	0
MnO_x-BVO	0	0.05
Ag-MnO_x-BVO	0.17	0.06