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Cation vacancy activating surface neighboring sites for efficient CO_2 photoreduction on $Bi_4Ti_3O_{12}$ nanosheets

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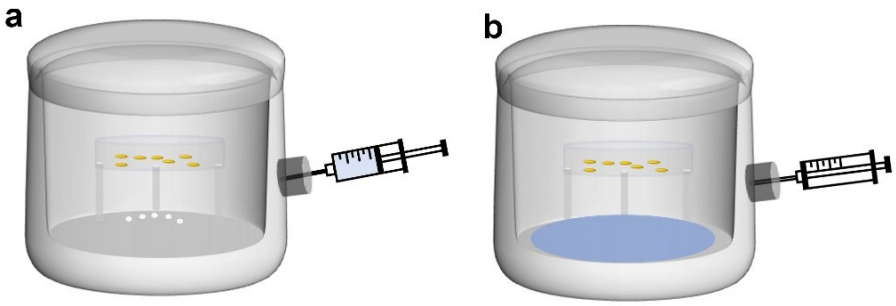

Figure S1. Schematic illustration of CO_2 photoreduction reactor.

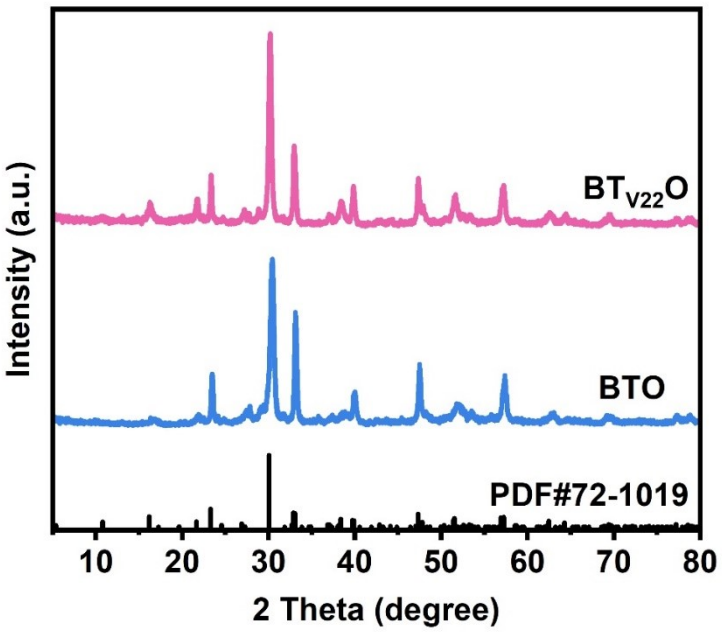

Figure S2. XRD patterns of BTO and $BT_{V22}O$.

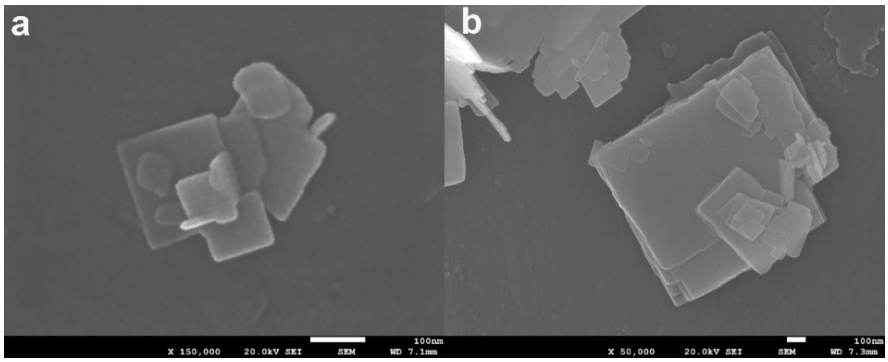

Figure S3. SEM images of (a) BTO and (b) $BT_{V22}O$.

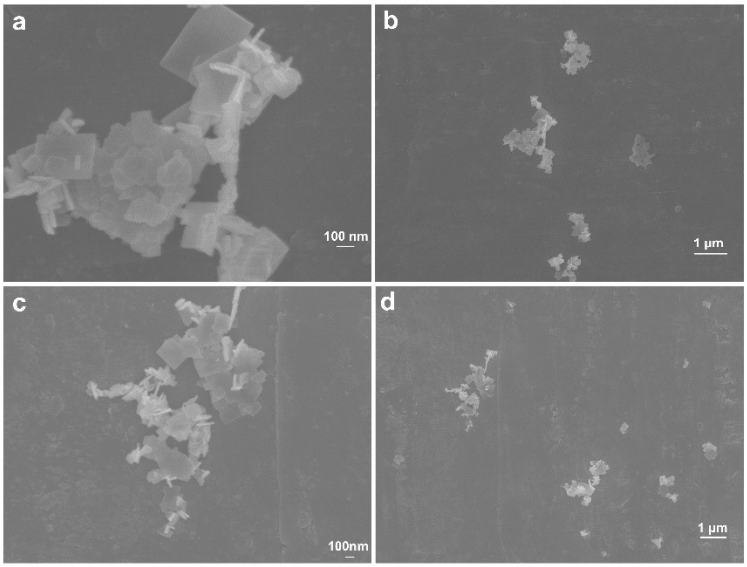

Figure S4. SEM images with different magnifications of (a, b) BTO and (c, d) $BT_{V22}O$.

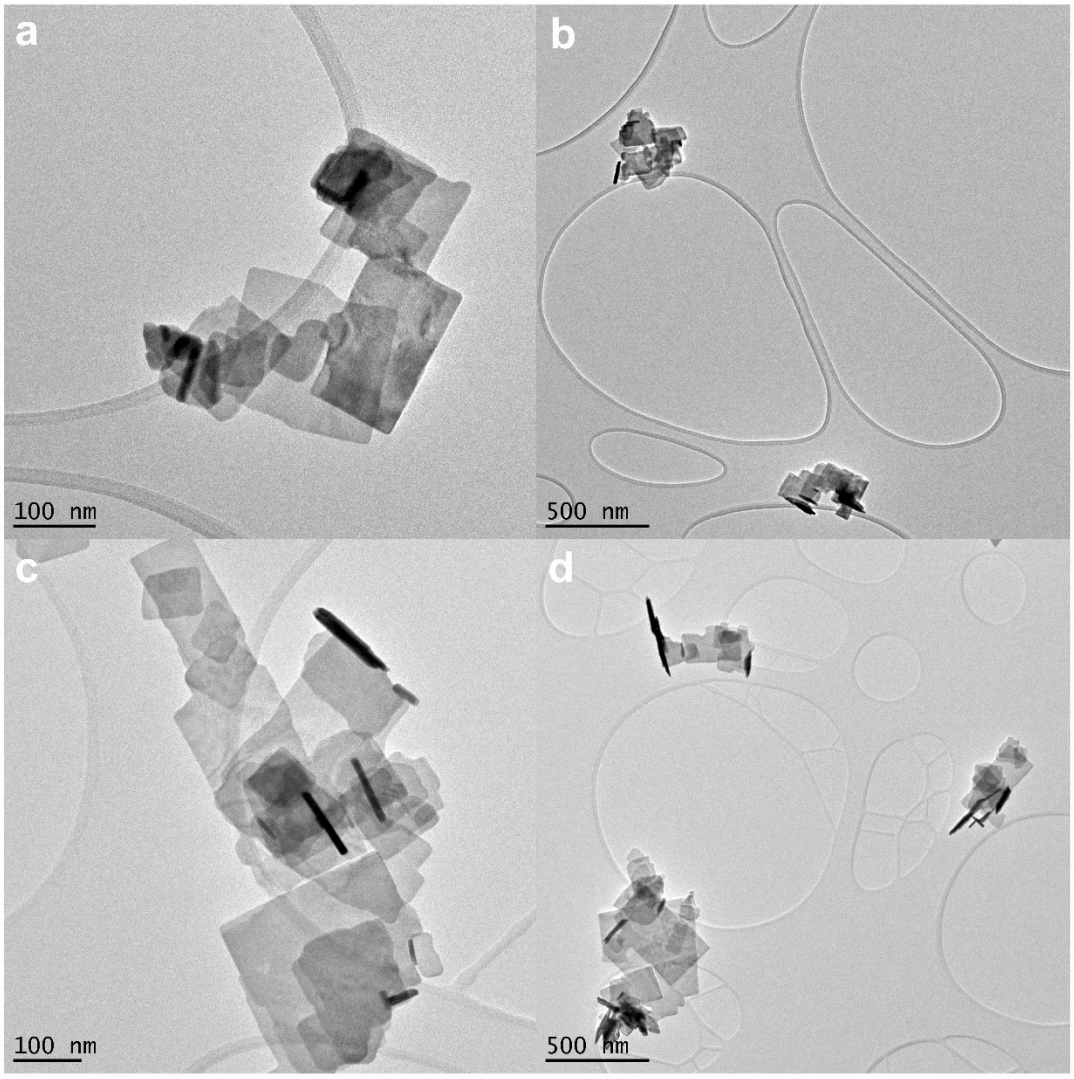

Figure S5. TEM images with different magnifications of (a, b) BTO and (c, d) $BT_{V22}O$.

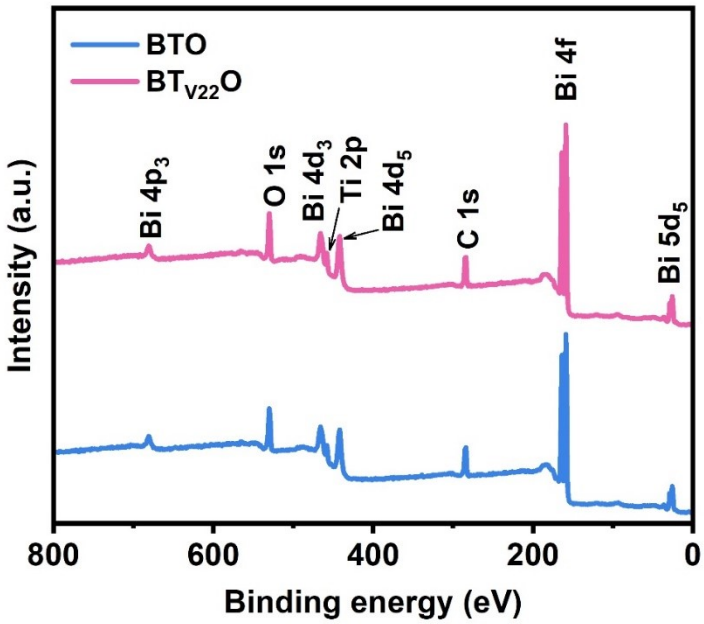

Figure S6. XPS spectra of BTO and $BT_{V22}O$.

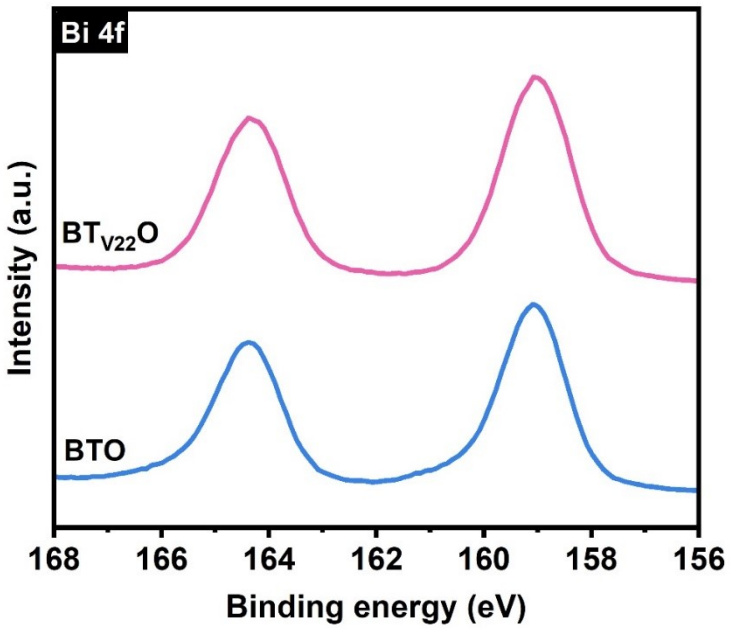

Figure S7. XPS spectra of Bi 4f of BTO and $BT_{V22}O$.

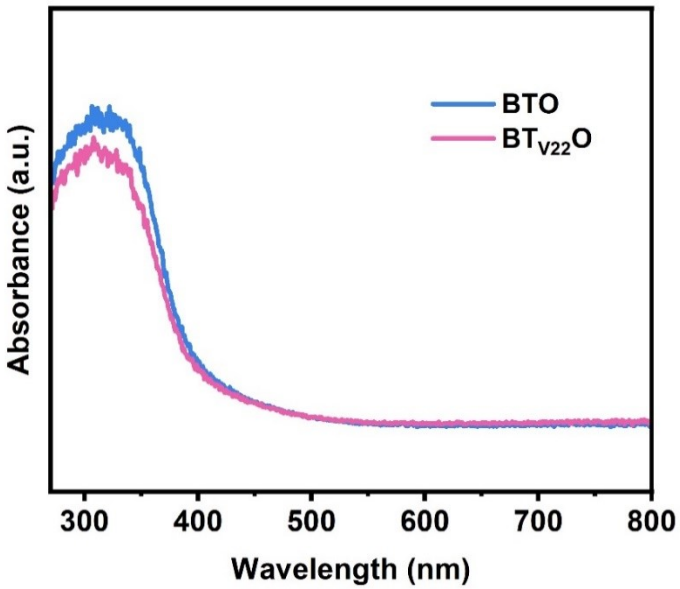

Figure S8. DRS spectra of BTO and $BT_{V22}O$.

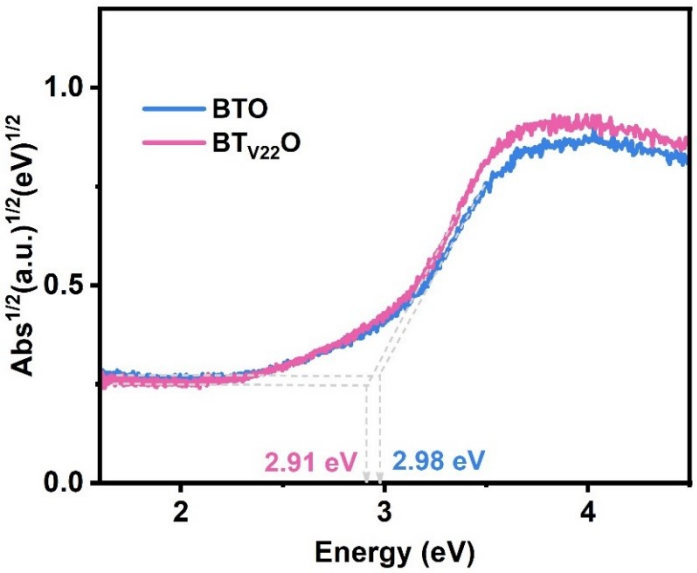

Figure S9. Bandgap of BTO and $BT_{V22}O$.

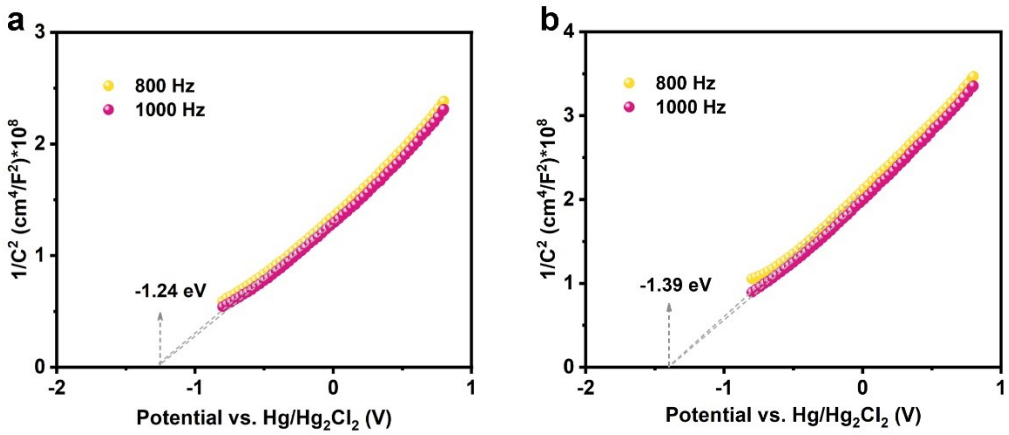

Figure S10. Mott-Schottky plots of (a) BTO and (b) $BT_{V22}O$.

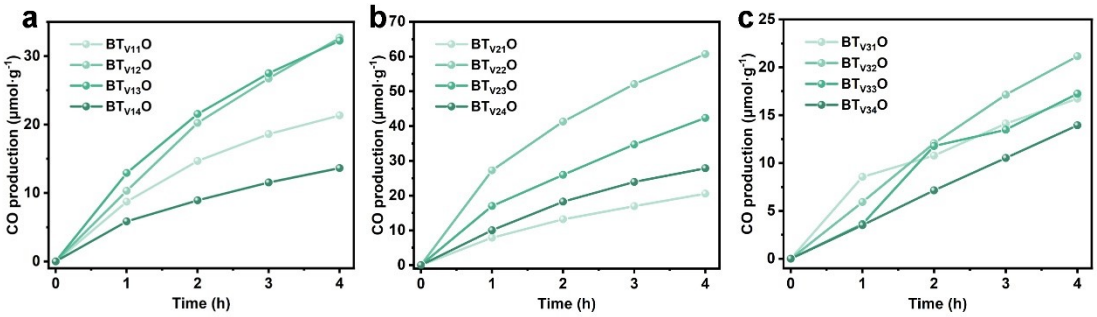

Figure S11. (a-c) Time-dependence CO production of $BT_{VXY}O$ (X=1, 2, 3; Y=1, 2, 3, 4).

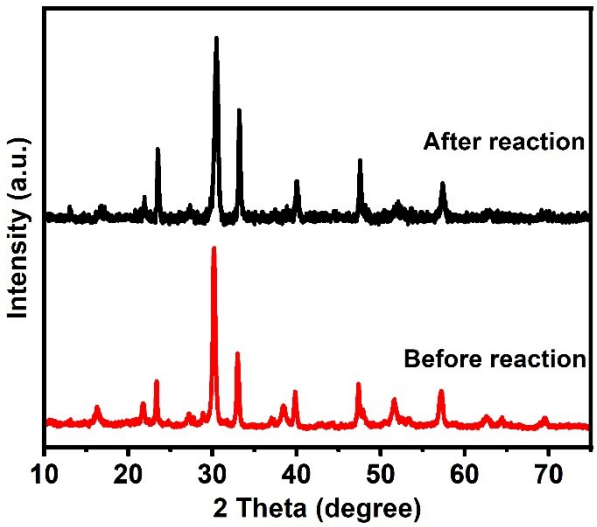

Figure S12. XRD patterns of $BT_{V22}O$ before and after photoreduction reaction.

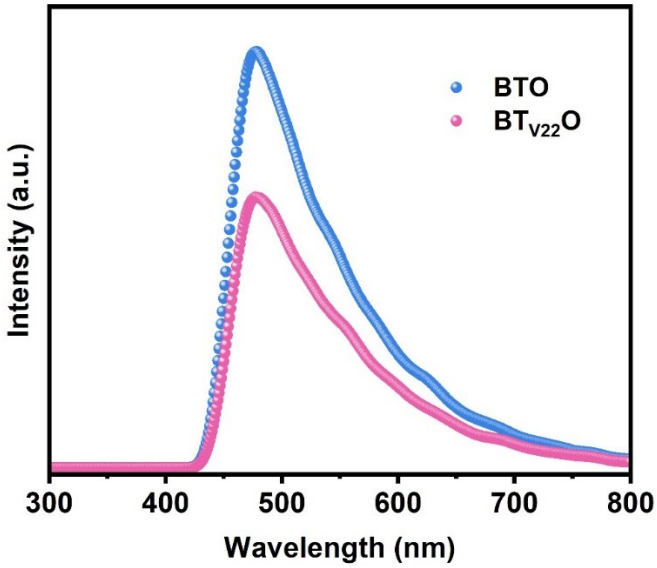

Figure S13. PL spectra of BTO and $BT_{V22}O$.

Table S1. The concentrations (wt%) of Ti vacancy. (0.1, 0.5 and 1 M corresponding to the NaOH concentrations; 15, 30, 60 and 90 min corresponding to the treating time)

Treating time	0.1 M	0.5 M	1.0 M
15 min	1.08	1.82	3.47
30 min	4.38	7.20	10.01
60 min	4.63	9.84	10.34
90 min	10.01	15.55	15.88

Table S2. Comparison of the CO_2 photoreduction activity of BTO with the some selected Bi-based catalysts reported in the references.

Photocatalyst	**Light sources**	**Photoactivity**	**Ref.**
$BT_{V22}O$	300W Xe lamp	CO: 15.17 μmol·g^{-1}·h^{-1}	This work
$Bi_4Ti_3O_{12}$ hollow-spheres	300W Xe lamp	CO: 13.1 μmol·g^{-1}·h^{-1}	[1]
$Bi_2O_2(OH)(NO_3)$ with Br grafting	300W Xe lamp	CO: 8.12 μmol·g^{-1}·h^{-1}	[2]
$BiVO_4/Bi_4Ti_3O_{12}$ heterojunction	300W Xe lamp	CO: 13.29 μmol·g^{-1}·h^{-1}	[3]
Hollow-hierarchical Bi_2WO_6 nanosheets	300 W Xe lamp	CH4: 2.6 μmol·g^{-1}·h^{-1}	[4]
Bi_2MoO_6	300W Xe lamp	CO: 14.38 μmol·g^{-1}·h^{-1}	[5]
BiOI flowerlike hierarchical structures	300W Xe lamp	CH_4: 0.40 μmol·g^{-1}·h^{-1}	[6]
g-C_3N_4/BiOCl heterostructures with OVs	300W Xe lamp	CO: 4.73 μmol·g^{-1}·h^{-1}	[7]

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