Electronic Supplementary Information

Regulating Effect of Heterojunction on Electrocatalytic Oxidation of Methanol for Pt/WO_3-$NaTaO_3$ Catalyst Regenerated CO

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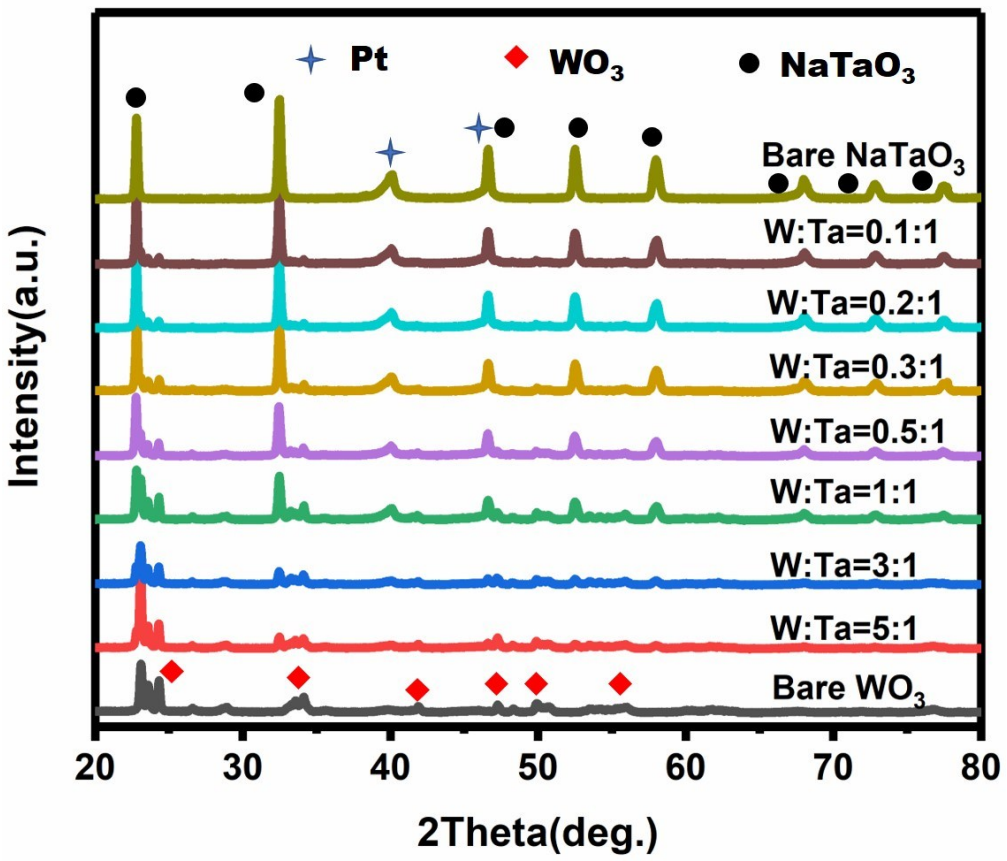

Fig. S1. XRD patterns of Pt/WO_3, $Pt/NaTaO_3$, and Pt/WO_3-$NaTaO_3$ composites with different molar ratio (W:Ta = 5:1, 3:1, 1:1, 0.5:1, 0.3:1, 0.2:1, 0.1:1).

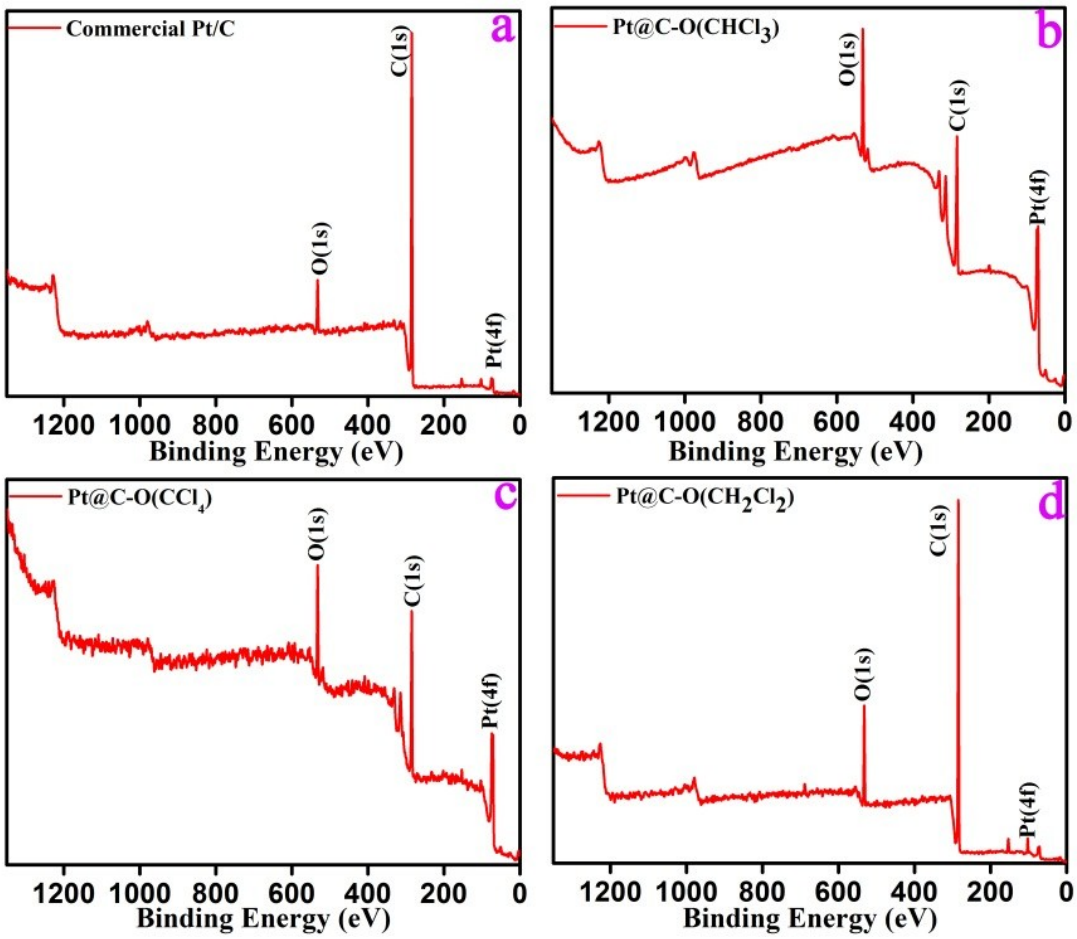

Fig. S2. Full XPS spectrum of (a) pure WO_3, (b) bare $NaTaO_3$, (c) Pt/WO_3-$NaTaO_3$ composites with W:Ta =3:1, (d) Pt/WO_3-$NaTaO_3$ composites with W:Ta =0.2:1.

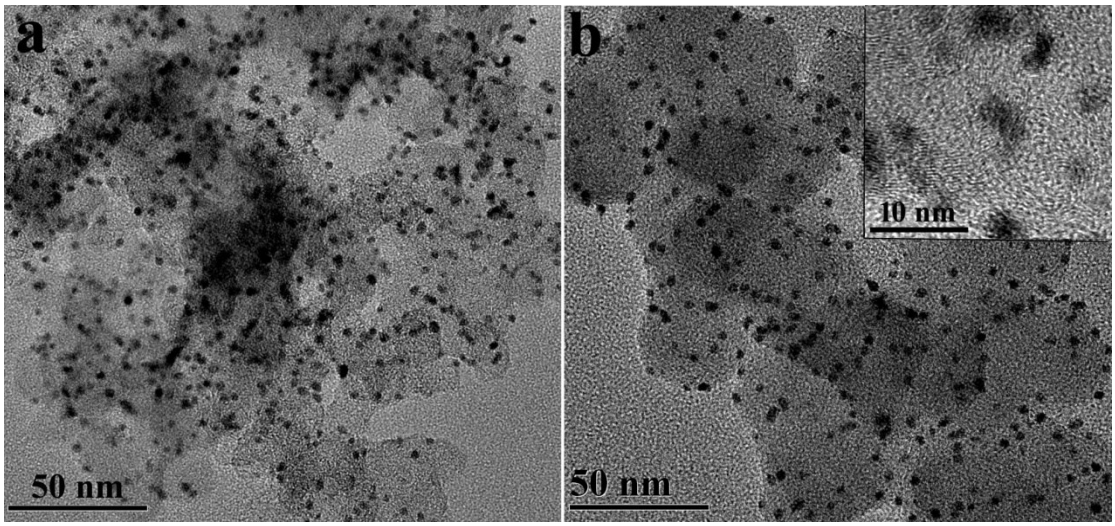

Fig. S3. TEM and HRTEM images of the commercial Pt/C (20 wt.%).

Table S1. The electrochemically active surface area (ECSA) calculated by the cyclic voltammetric curves in Fig. 7 and the onset potential, peak potential, current density and the tolerance (I_f/I_b) of commercial Pt/C catalyst and three as-prepared Pt/WO_3-$NaTaO_3$ composite catalysts in acid.

Type of Pt/C catalyst	**ECSA/$m^3 \cdot g^{-1}Pt$**	**Oneset potential/V**	**Peak potential/V**	**Current density /$mA \cdot cm^{-2}$**	**I_f/I_b**
Pt/WO_3-$NaTaO_3$ W:Ta = 5:1	16.8	0.42	0.64	55	0.81
Pt/WO_3-$NaTaO_3$ W:Ta = 3:1	40.6	0.35	0.69	120	1.19
Pt/WO_3-$NaTaO_3$ W:Ta = 1:1	31.88	0.36	0.68	100	1.12
Pt/WO_3-$NaTaO_3$ W:Ta = 0.5:1	23.41	0.35	0.62	85	1.09
Pt/WO_3-$NaTaO_3$ W:Ta = 0.3:1	21.6	0.45	0.64	70	1.06
Pt/WO_3-$NaTaO_3$ W:Ta = 0.2:1	18.3	0.41	0.63	60	0.98
Pt/WO_3-$NaTaO_3$ W:Ta = 0.1:1	13.2	0.44	0.64	30	0.92
commercial Pt/C	14.4	0.41	0.64	40	0.88
Pt/WO_3	14.3	0.43	0.65	35	0.86
Pt/$NaTaO_3$	13.6	0.46	0.65	30	0.79

Table S2. The electrochemically active surface area (ECSA) calculated by the cyclic voltammetric curves in Fig. 8 and the onset potential, peak potential, current density and the tolerance (I_f/I_b) of commercial Pt/C catalyst and three as-prepared Pt/WO_3-$NaTaO_3$ composite catalysts in alkali.

Type of Pt/C catalyst	**ECSA/$m^3 \cdot g^{-1}Pt$**	**Oneset potential/V**	**Peak potential/V**	**Current density /$mA \cdot cm^{-2}$**	**I_f/I_b**
Pt/WO_3-$NaTaO_3$ W:Ta = 5:1	13.7	-0.36	-0.14	28	0.86
Pt/WO_3-$NaTaO_3$ W:Ta = 3:1	22.51	-0.37	-0.09	48	1.15
Pt/WO_3-$NaTaO_3$ W:Ta = 1:1	24.3	-0.38	-0.09	55	1.09
Pt/WO_3-$NaTaO_3$ W:Ta = 0.5:1	26.3	-0.44	-0.06	60	1.02
Pt/WO_3-$NaTaO_3$ W:Ta = 0.3:1	29.1	-0.45	-0.05	75	0.99
Pt/WO_3-$NaTaO_3$ W:Ta = 0.2:1	31.9	-0.51	-0.1	90	0.93
Pt/WO_3-$NaTaO_3$ W:Ta = 0.1:1	13.2	-0.36	-0.094	23	0.89
commercial Pt/C	13.5	-0.37	-0.131	28	0.81
Pt/WO_3	7.17	-0.32	-0.178	18	0.78
Pt/$NaTaO_3$	14.2	-0.38	-0.092	30	0.88

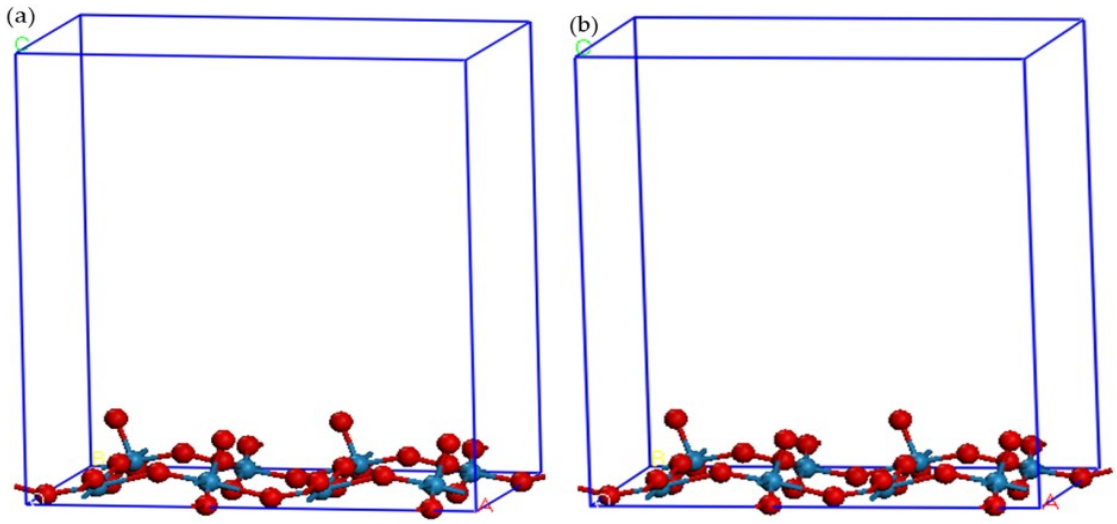

Fig. S4. Schematic drawing of supercell model for WO_3(020) surface: (a) before relaxation, (b) after relaxation.

Table S3. Chemical adsorption energy (ΔE_{chem}) of CH_3OH molecule on different location for WO_3(020) surface.

Adsorption location	ΔE_{chem} (eV)
W-top	-0.19
W-W	0.77
hollow	0.89

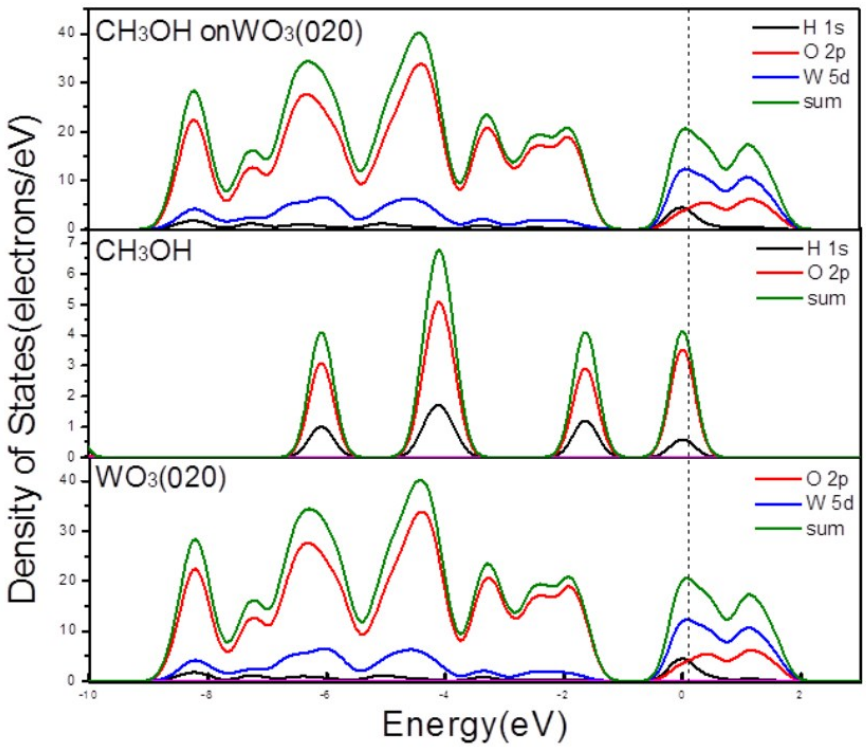

Fig. S5. Density of state for CH_3OH molecule adsorbed on W-top site of $WO_3(020)$.