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ARTICLE

Supplementary information for Partial oxidation of ethylbenzene by H_2O_2 on VO_x/HZSM-22 catalyst

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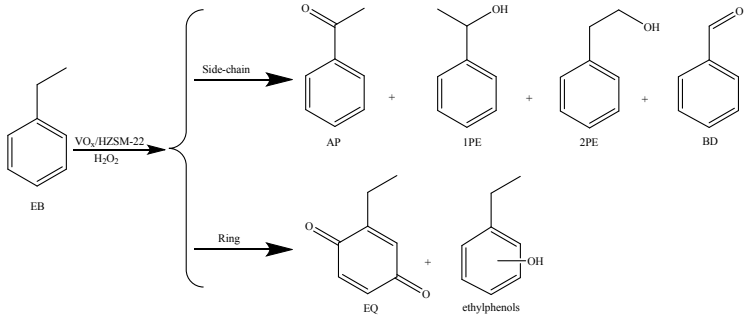

Scheme S1 The reaction scheme of partial oxidation of ethylbenzene

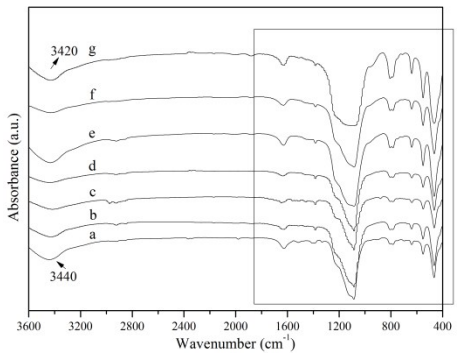

Fig. S1 FTIR spectra of samples with different vanadium content: a-HZSM-22, b-0.09 wt% VO_x/HZSM-22, c-0.36 wt% VO_x/HZSM-22, d-0.71 wt% VO_x/HZSM-22, e-0.96 wt% VO_x/HZSM-22, f-1.81 wt% VO_x/HZSM-22, g-2.86 wt% VO_x/HZSM-22.

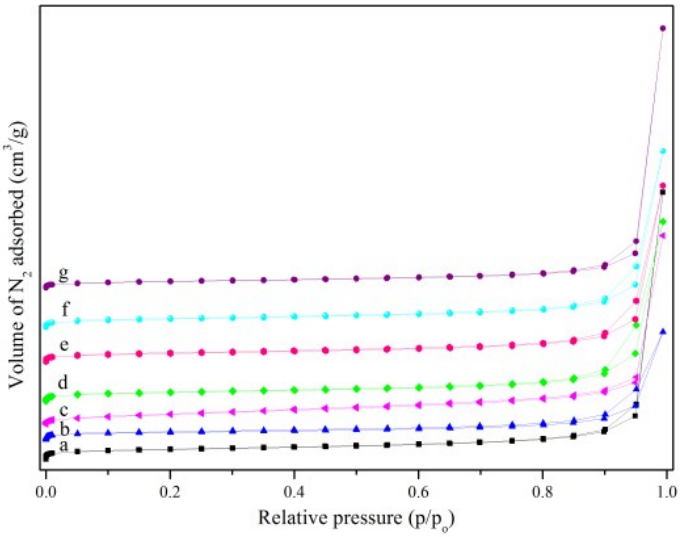

Fig. S2 N_2 adsorption-desorption isotherms: a-HZSM-22, b-0.09 wt% VO_x/HZSM-22, c-0.36 wt% VO_x/HZSM-22, d-0.71 wt% VO_x/HZSM-22, e-0.96 wt% VO_x/HZSM-22, f-1.81 wt% VO_x/HZSM-22, g-2.86 wt% VO_x/HZSM-22.

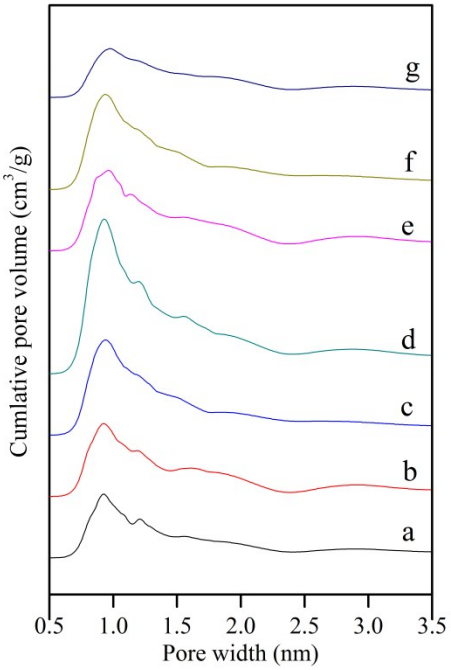

Fig. S3 Pore size distributions calculated by Saito-Foley Method: a-HZSM-22, b-0.09 wt% VO_x/HZSM-22, c-0.36 wt% VO_x/HZSM-22, d-0.71 wt% VO_x/HZSM-22, e-0.96 wt% VO_x/HZSM-22, f-1.81 wt% VO_x/HZSM-22, g-2.86 wt% VO_x/HZSM-22.

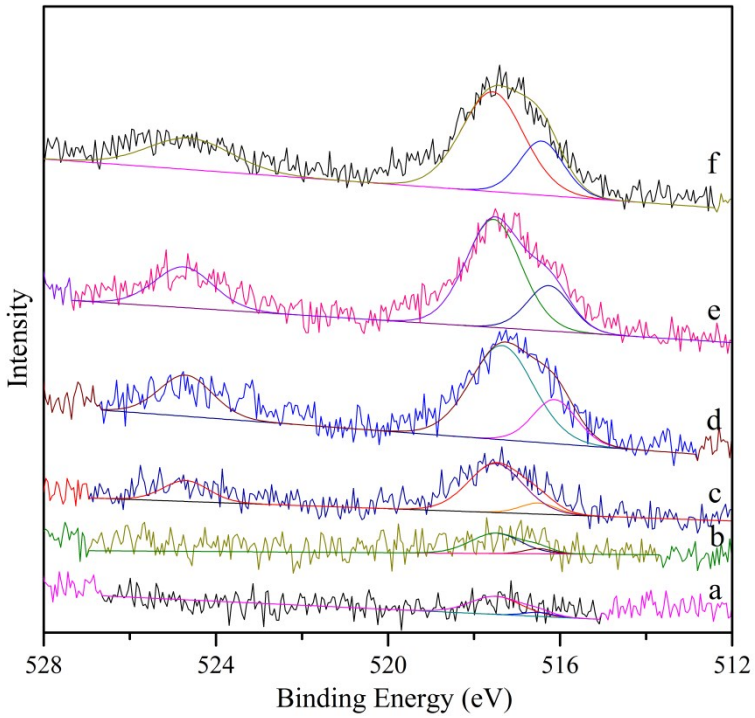

Fig. S4 The XPS spectra of V on the V/HZSM-22 with different vanadium content: a-0.09 wt% VO_x/HZSM-22, b-0.36 wt% VO_x/HZSM-22, c-0.71 wt% VO_x/HZSM-22, d-0.96 wt% VO_x/HZSM-22, e-1.81 wt% VO_x/HZSM-22, f-2.86 wt% VO_x/HZSM-22.

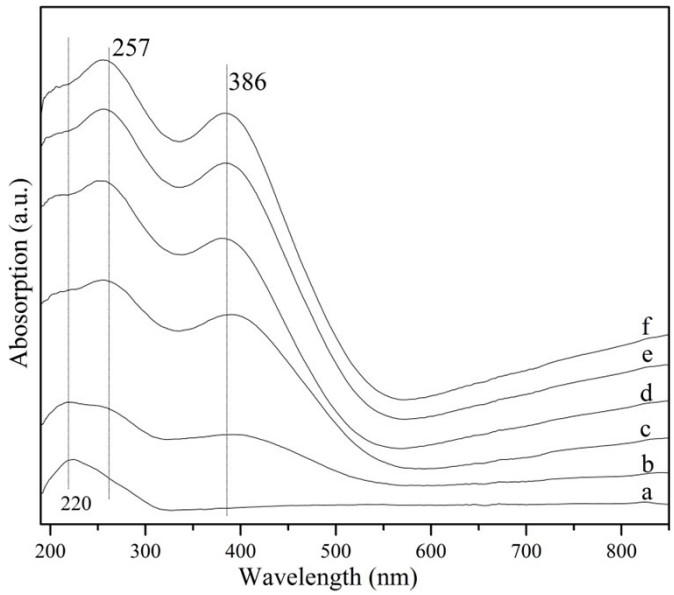

Fig. S5 DR UV-vis spectra of all the samples: a-0.09 wt% VO_x/HZSM-22, b-0.36 wt% VO_x/HZSM-22, c-0.71 wt% VO_x/HZSM-22, d-0.96 wt% VO_x/HZSM-22, e-1.81 wt% VO_x/HZSM-22, f-2.86 wt% VO_x/HZSM-22.

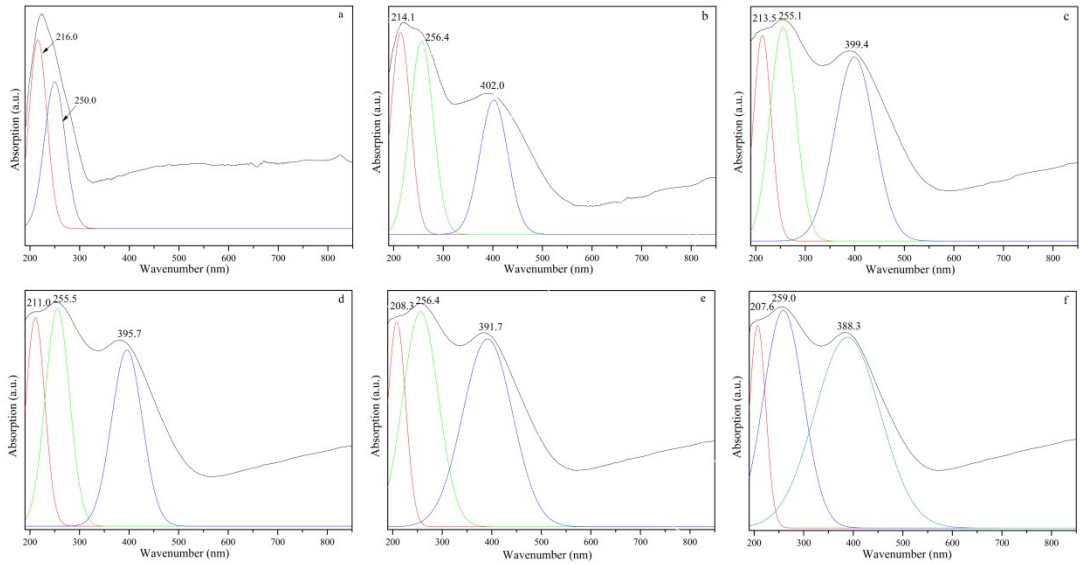

Fig. S6 DR UV-vis spectra of deconvolution to sub-bands: a-0.09 wt% VO_x/HZSM-22, b-0.36 wt% VO_x/HZSM-22, c-0.71 wt% VO_x/HZSM-22, d-0.96 wt% VO_x/HZSM-22, e-1.81 wt% VO_x/HZSM-22, f-2.86 wt% VO_x/HZSM-22.

Table S1 Recyclability of the used catalysts

Catalyst	Conv. (%)	S_{AP} (%)	$S_{Side\text{-}chain}$ (%)	S_{ring} (%)	Y_{AP} (%)	Y_{BD} (%)	Y_{1PE} (%)	Y_{EQ} (%)	$Y_{ethylphenols}$ (%)
Fresh catalyst	24.4	71.7	92.6	7.4	17.5	2.3	2.7	0.1	1.7
Second circle.	1.1	48.4	73.4	26.6	0.5	0.1	0.1	0.0	0.4
Third circle	0.1	0	0	100.0	0.0	0.0	0.0	0.0	0.1
Regenerated catalyst	2.8	54.1	82.7	17.3	1.5	0.3	0.5	0.0	0.5
Used catalyst(H_2O_2)	2.2	14.3	24.1	75.9	0.3	0.1	0.1	0.0	1.7
Used catalyst(CH_3CN)	17.0	74.1	93.5	6.5	12.6	1.6	1.6	0.2	0.9
Solvent(H_2O_2)	2.1	32.2	48.0	52.0	0.7	0.2	0.1	0.0	1.1

Reaction condition: 200 mg 1.81 wt% VO_x/HZSM-22, 70 °C, 4 h, 49.9 mmol 30 wt% H_2O_2, 8.2 mmol ethylbenzene, 10 ml acetonitrile