Supplementary information

The remarkable promotional effect of Sn on $CeVO_4$ catalyst for wide temperature NH_3-SCR process by citric acid-assisted solvothermal synthesis and post-hydrothermal treatment

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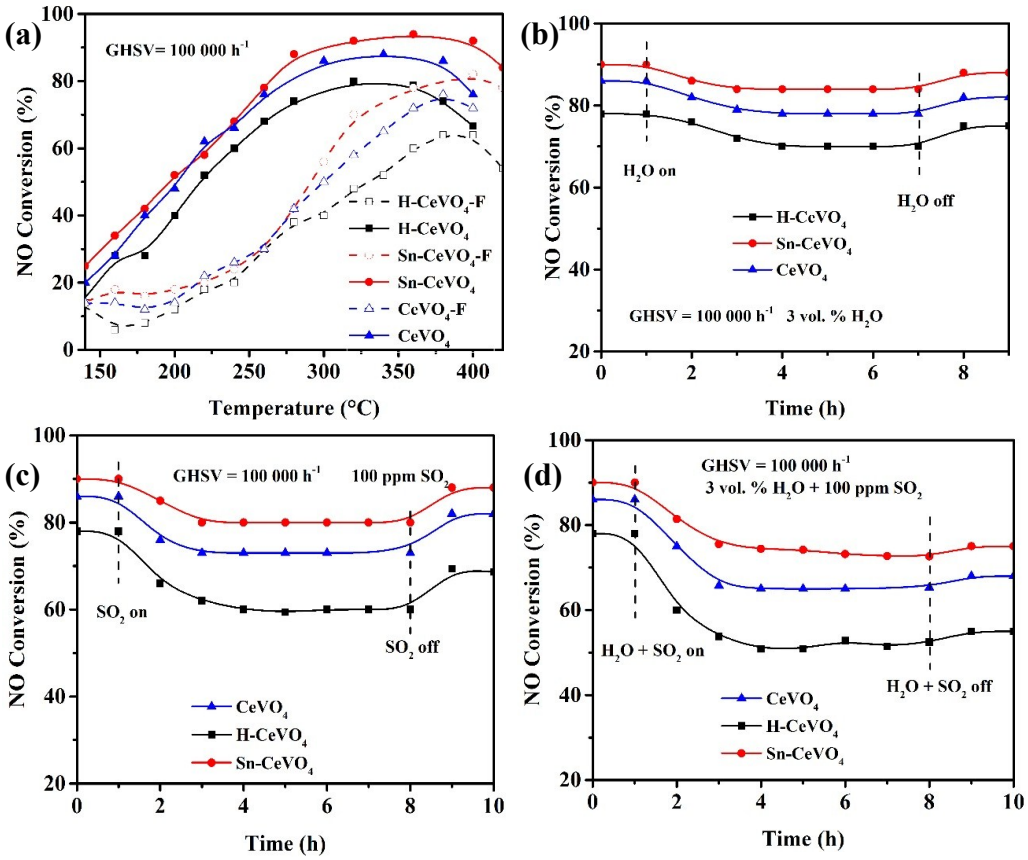

Fig. S1 Catalytic activity for NO reduction of all as-prepared catalysts (GHSV=100,000 h^{-1}).

Table S1 Assignment of Raman signals registered on all samples

Wavenumber (cm^{-1})	Mode	Ref.
146	B_{2g} [δ(O=V-O)]	1, 2
197	A_g [δ(V-O-V)]	1, 2
260	B_{3g} [δ(V–O-V)]	1, 3, 4
284	B_{3g} [δ(O=V-O)]	1, 2, 5, 6
304	B_{1g} [δ(V–O-V)]	1, 2, 5
406	A_g [δ(V–O–V)]	1, 2, 5, 6
460	F_{2g} [υ(Ce-O)]	6-8
468	B_{2u} [δ(V-O-V)]	1, 2, 5
526	A_g [υ(V-O-V)]	1, 2, 5
702	B_{2g} [υ(V-O-V)]	1, 2, 5
785	E_g [υ_{as}(V-O-V)]	3, 4, 6
798	B_{2g} [υ_{as}(V-O-V)]	6
860	A_{1g} [υ_s(V-O-V)]	3, 6
996	A_g [υ_s(V=O)]	1-3, 5, 6, 9

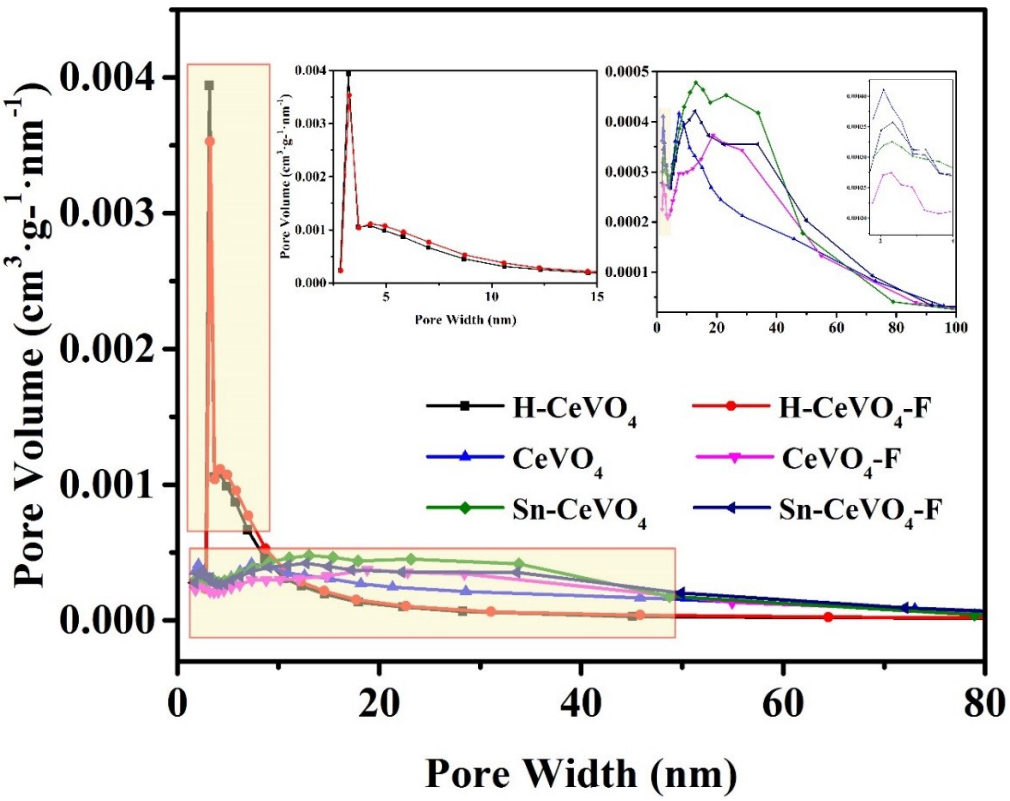

Fig. S2 Pore size distribution curves and enlarge parts of all as-prepared catalysts.

Table S2 physical chemical parameters of different solvents.

Solvent	Boiling point (°C)	Viscosity (20 °C)	Polarity
ethylene glycol	197	19.9	6.9
isopropanol	82	2.37	4.3
water	100	1	10.2

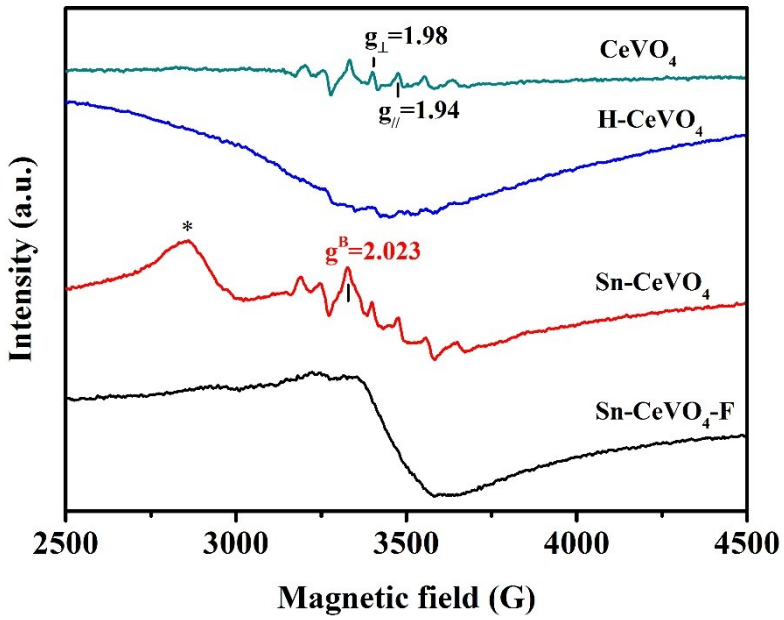

Fig. S3 EPR spectra of H-$CeVO_4$, $CeVO_4$, Sn-$CeVO_4$ and Sn-$CeVO_4$-F

Table S3 Surface composition of catalysts (%)

Sample	Ce	V	O	Sn	S
H-$CeVO_4$	15.0	25.8	59.3	-	-
$CeVO_4$	13.2	29.2	57.5	-	-
$CeVO_4$-R	12.6	26.6	54.0	-	6.8
Sn-$CeVO_4$-F	6.7	28.2	55.7	9.3	-
Sn-$CeVO_4$	8.0	27.2	55.9	8.9	-
Sn-$CeVO_4$-R	6.9	26.7	54.7	8.7	3.0

Table S4 The amount of surface acid sites.

Samples	Weak acid		Medium acid		Strong acid		Sum area (a.u)
	Temp. (°C)	Area (a.u.)	Temp. (°C)	Area (a.u.)	Temp. (°C)	Area (a.u.)	
$CeVO_4$	253	124.3	312	229.0	401	12.3	365.6
Sn-$CeVO_4$	251	155.7	310	291.3	400	78.6	525.6
H-$CeVO_4$	267	82.1	320	130.9	401	14.4	188.8

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