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Supplementary Material

Effect of Cerium Precursor in the Synthesis of Ce-MCM-41 and in the Efficiency for Liquid-Phase Oxidation of Benzyl Alcohol

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FIGURES

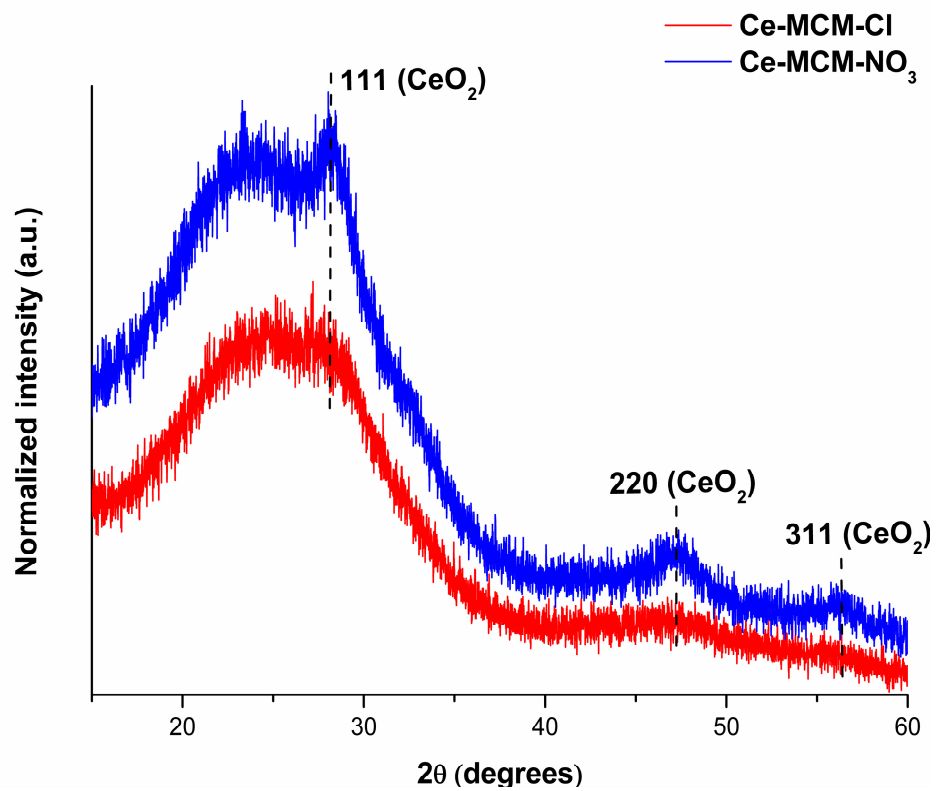

Figure S1. XRD patterns of Ce-MCM-Cl and Ce-MCM-NO_3 materials at high angle region.

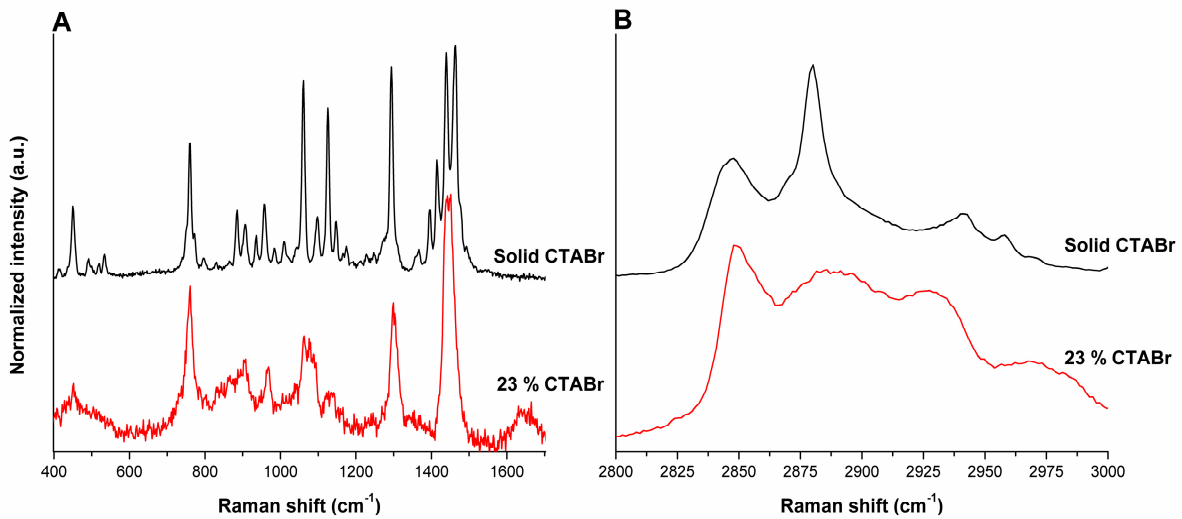

Figure S2. Raman spectra of CTA^+ systems between 400 - 1700 cm^{-1} (A) and 2800 – 3000 cm^{-1} (B).

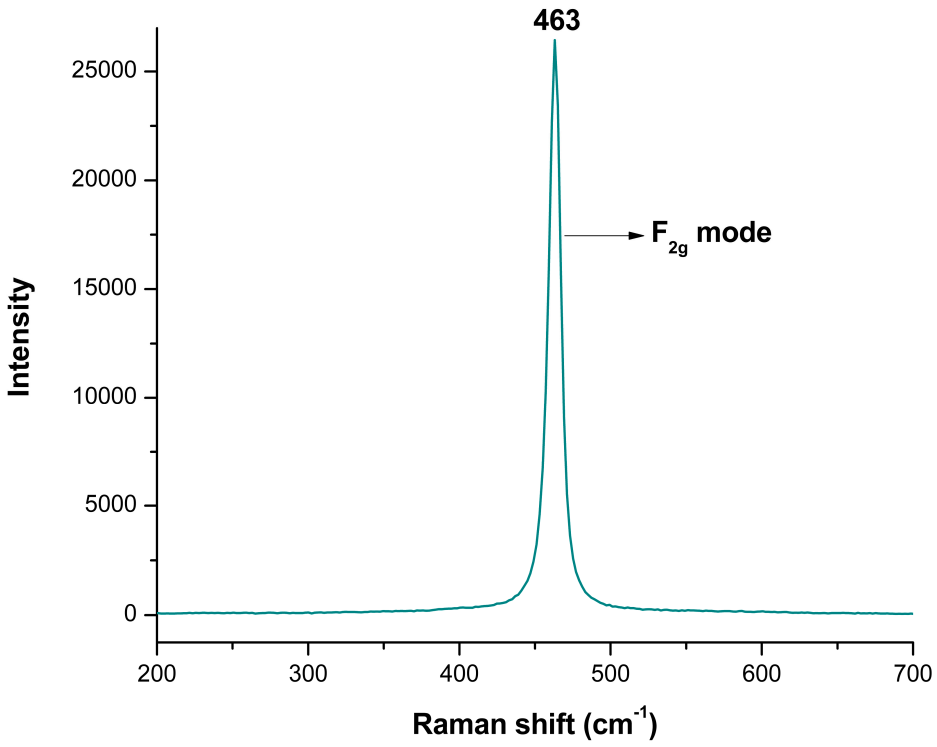

Figure S3. Raman spectrum of crystalline CeO_2.

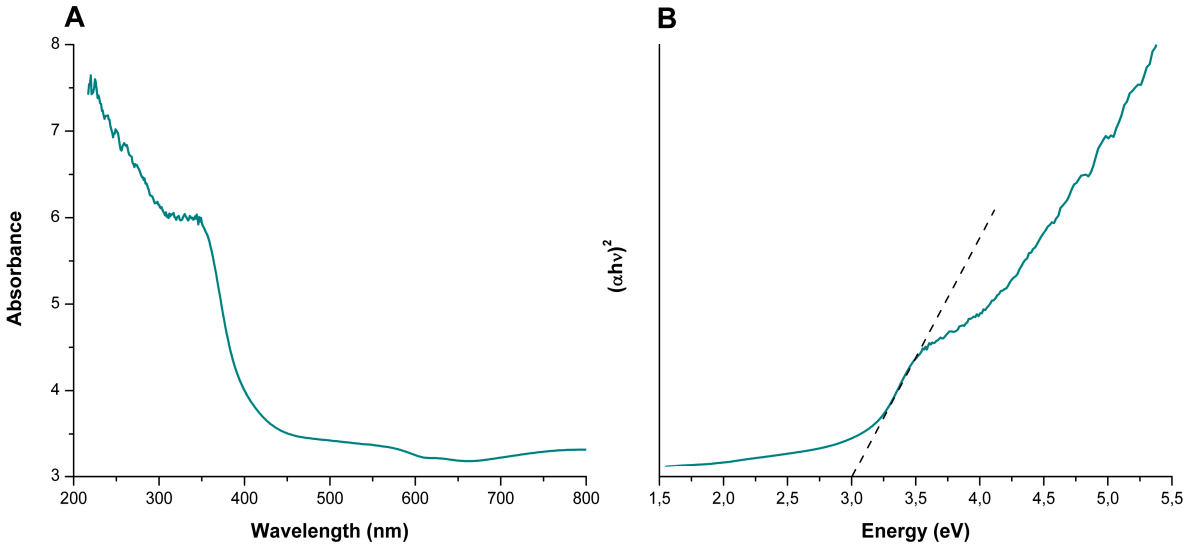

Figure S4. Absorption spectra (A) and Davis-Mott plot (B) for of CeO_2.

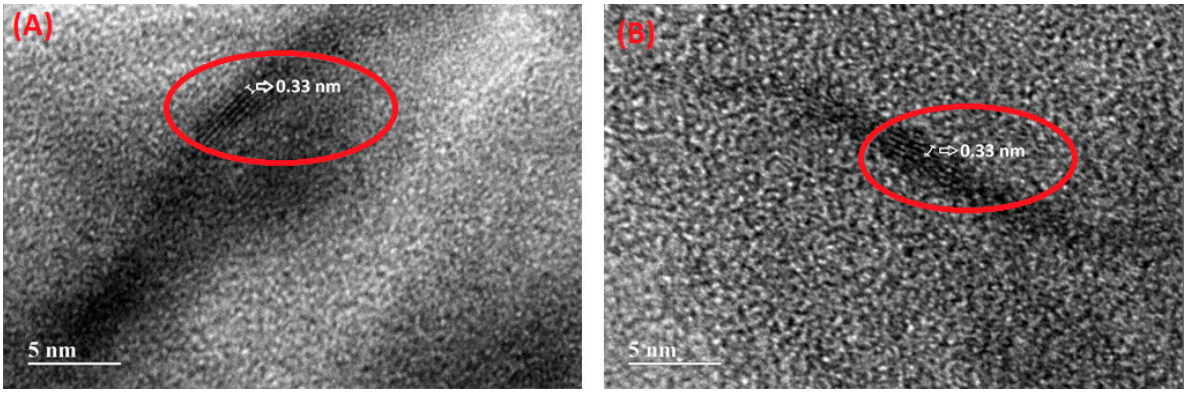

Figure S5. High magnification in HRTEM images highlighting CeO_2 110 interplanar spacing for: Ce-MCM-Cl (A) and Ce-MCM-NO_3 (B).

TABLES

Table S1. Raman band assignments for CTA^+ cations in as-synthesized MCM-41 materials and template standards [50,53,54].

Raman shifts (cm^{-1}) for observed bands					Assignment
Solid CTABr	23 wt.% CTABr	A-Si-MCM-41	A-Ce-MCM-Cl	A-Ce-MCM-NO_3	
450	452	446			longitudinal accordion mode
492		510			longitudinal accordion mode
520					longitudinal accordion mode
534					longitudinal accordion mode
761	761	761	761	757	CH_3 rock from $N(CH_3)_3$
773					CH_3 rock from $N(CH_3)_3$
885					terminal CH_3 rock
906	908	910	911	913	ν_s C-N^+
936					ν_a C-N^+
957	968	964	968	964	CH_2 rock
983					CH_2 rock
1011					CH_2 rock
1045	1041	1041	1040	1039	CH_2 twist
1061	1063	1061	1063	1063	ν_s C-C + CH_2 wag
	1076	1076	1076	1076	ν_s C-C gauche
1098					ν_s C-C, crystalline
1126	1122	1120	1122	1120	ν_a C-C + CH_2 wag
	1140	1135	1138	1134	ν_a C-C gauche
1175					CH_2 wag, crystalline
1213					CH_2 wag, crystalline
1228					CH_2 wag, crystalline
1247					CH_2 wag, crystalline
1294	1299	1299	1299	1296	CH_2 twist
1367					δ_s C-CH_3
1395					δ_s C-H from $N(CH_3)_3$
1415					δ_s C-H from CH_2, crystalline
1439	1443	1449	1449	1448	δ C-H from CH_2
1464					δ_a C-H from CH_2, crystalline
2848	2848	2849	2851	2848	ν_s C-H from CH_2
2880	2885	2884	2884	2887	ν_s C-H from CH_2
2941	2928	2923	2920	2920	ν_a C-H from CH_3
2958	2968	2966	2965	2966	ν_a C-H from CH_3

Table S2. TGA results for the as-synthesized MCM-41 materials.

Sample	Temperature range (°C)	Mass loss (%)	DTG maximum (°C)	CTA^+/SiO_2 ratio
A-Si-MCM-41	R.T.-129	6.27	61	0.163
	129-270	23.32	248	
	270-322	10.81	284	
	322-482	5.59	332	
	482-1000	2.44	-	
	R.T.-1000	48.43	-	
A-Ce-MCM-Cl	R.T-121	5.71	62	0.154
	121-283	22.74	245	
	283-312	2.48	304	
	312-350	2.72	-	
	350-452	8.54	395	
	452-1000	3.72	-	
	R.T.-1000	45.91	-	
A-Ce-MCM-NO_3	R.T.-128	5.93	62	0.155
	128-291	22.77	249	
	291-317	2.37	309	
	317-358	3.06	-	
	358-494	8.60	400	
	494-1000	2.61	-	
	R.T.-1000	45.34	-	

Table S3. TGA results for the calcined MCM-41 materials.

Sample	Temperature range (°C)	Mass loss (%)	DTG maximum (°C)	Normalized silanol condensation mass loss (%)
Si-MCM-41	R.T.-118	4.58	58	1.70
	118-1000	1.62	-	
	R.T.-1000	6.20	-	
Ce-MCM-Cl	R.T-148	14.23	76	3.50
	148-1000	3.00	-	
	R.T.-1000	17.23	-	
Ce-MCM-NO_3	R.T.-128	12.29	67	2.67
	128-1000	2.34	-	
	R.T.-1000	14.63	-	

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