Supplementary Materials

Mesoporous Copper-Cerium Mixed Oxide Catalysts for Aerobic Oxidation of Vanillyl Alcohol

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Table S1 Normalised activity of catalysts with respect to BET surface area.

Entry	Catalyst	SA (m^2g^{-1})	Conv. (%)	NA (Conv./SA) x 100
1	CuO	14	22	157
2	CeO_2	51	35	69
3	$Cu_{0.05}Ce_{0.95}O_{2-\delta}$	75	73	97
4	$Cu_{0.1}Ce_{0.9}O_{2-\delta}$	81	95	117
5	$Cu_{0.15}Ce_{0.85}O_{2-\delta}$	69	86	125

SA = Surface area, Conv. = Conversion, NA = Normalised activity.

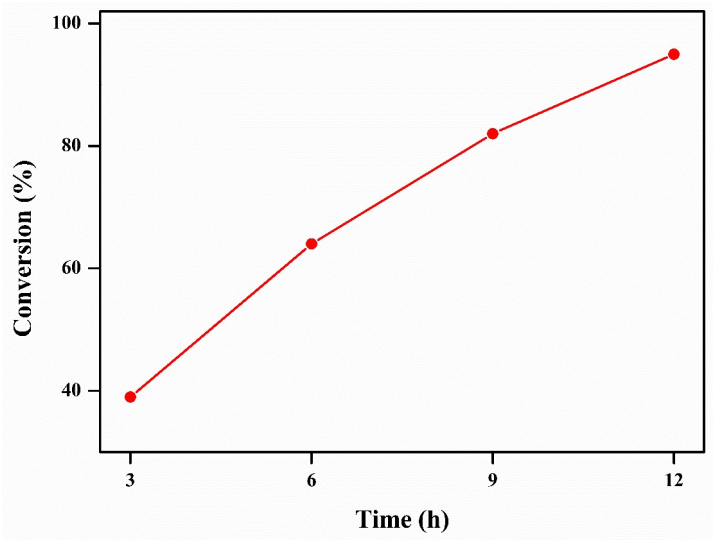

Figure S1. Effect of reaction time over $Cu_{0.1}Ce_{0.9}O_{2-\delta}$ catalyst. Reaction conditions: vanillyl alcohol (200 mg), catalyst (50 mg), O_2 (balloon), temperature (130 °C), and N, N-dimethylformamide (10 ml).

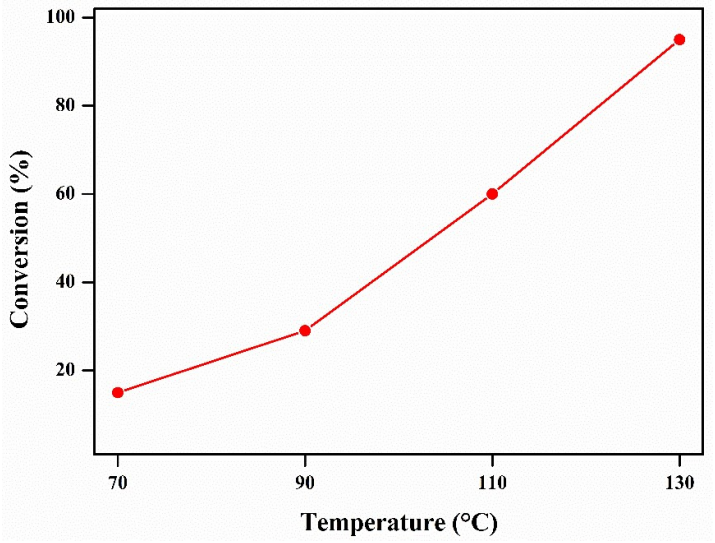

Figure S2. Effect of temperature over $Cu_{0.1}Ce_{0.9}O_{2-\delta}$ catalyst. Reaction conditions: vanillyl alcohol (200 mg), catalyst (50 mg), O_2 (balloon), time (12 h), and N, N-dimethylformamide (10 ml).

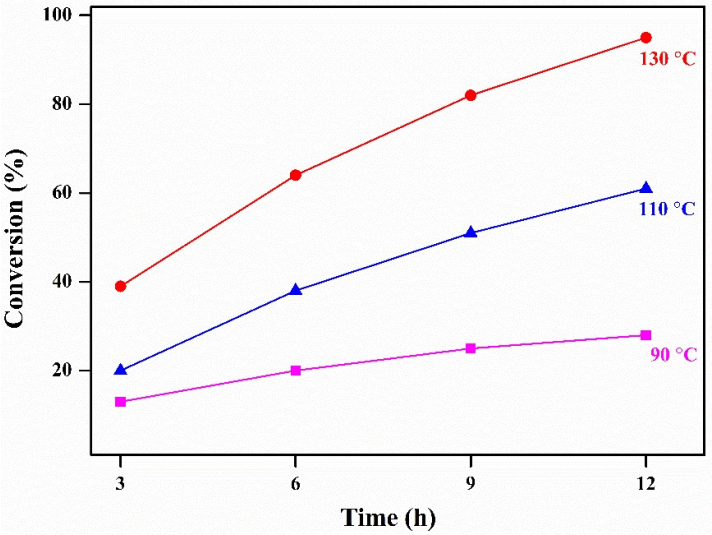

Figure S3. Effect of reaction time duration at various temperatures over $Cu_{0.1}Ce_{0.9}O_{2-\delta}$ catalyst. Reaction conditions: vanillyl alcohol (200 mg), catalyst (50 mg), O_2 (balloon), and N, N-dimethylformamide (10 ml).

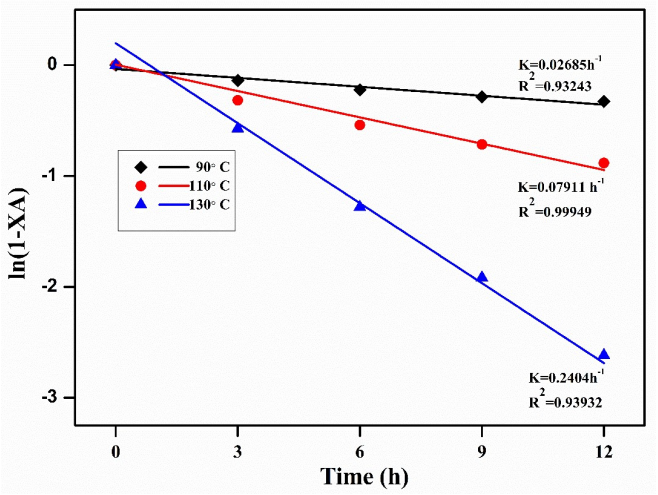

Figure S4. ln (1 - XA) versus reaction time duration for oxidation of vanillyl alcohol.

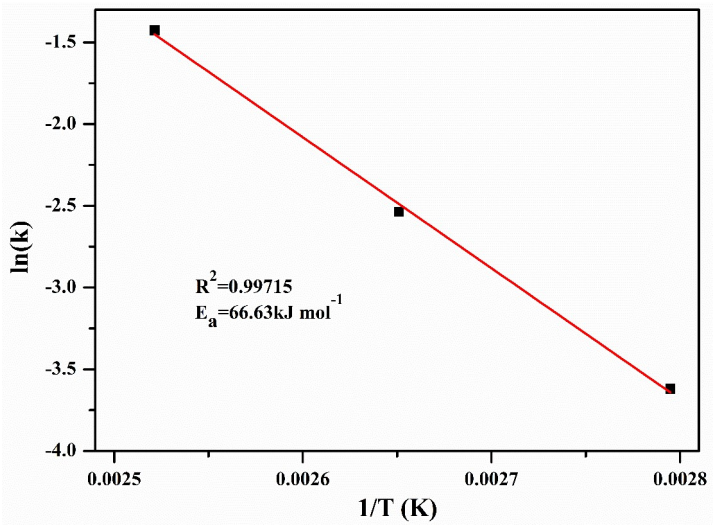

Figure S5. Arrhenius plot: ln(k) versus 1/T (T is in Kelvin).

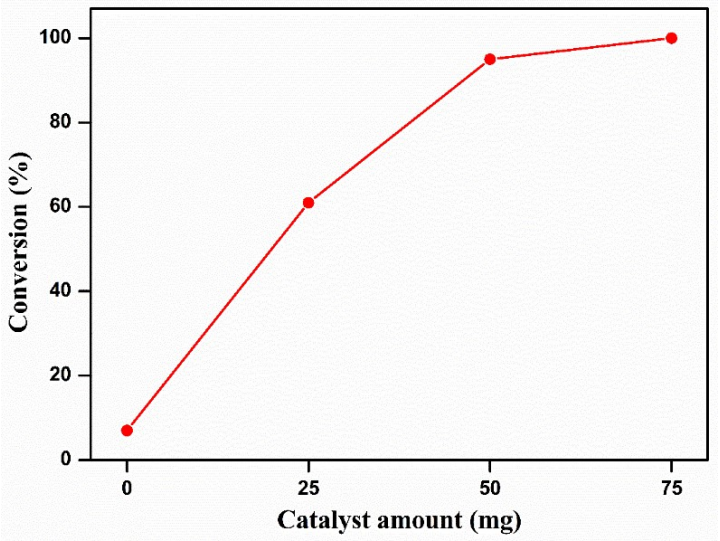

Figure S6. Effect of catalyst amount over $Cu_{0.1}Ce_{0.9}O_{2-\delta}$. Reaction conditions: vanillyl alcohol (200 mg), O_2 (balloon), time (12 h), temperature (130 °C), and N, N-dimethylformamide (10 ml).

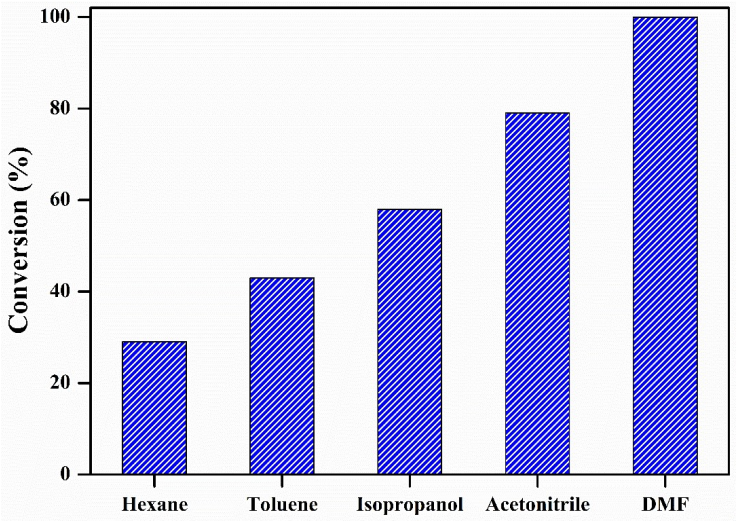

Figure S7. Effect of various solvents over $Cu_{0.1}Ce_{0.9}O_{2-\delta}$ catalyst. Reaction conditions: vanillyl alcohol (500 mg), O_2 (20 bar), time (4 h), catalyst (100 mg), temperature (130 °C), and solvent (25 ml).

Table S2 Comparison of present results with previously reported studies.

Entry[a]	Catalyst	Oxidant	Temp. (°C)	Pres. (bar)	Solvent	Time (hours)	Cat. amnt. (mg)	VA amnt. (mg)	Conv. (%)	Sel. (%)
1 (Ref. 22)	Co–Mn Mixed oxide	O_2 (air)	140	21	ACN	2	100	500	62	83
2 (Ref. 19)	Co_3O_4 nano-particles	O_2+base	80	6.8	IPA	6	100	500	80	98
		O_2							25	88
3 (Ref. 9)	mesoporous Cu-Ti	O_2 (air)	120	21	ACN	2	150	464	94	86
4 (Ref. 35)	Mn-doped ceria solid solution	O_2	140	20	ACN	4	100	500	89	95
5 (Ref. 36)	Ce-Zr-O solid solution	O_2	140	20	ACN	5	150	464	98	99
6 (Ref. 37)	Ce-Fe mixed oxide	O_2	140	20	ACN	5	100	300	91	99
7 (Ref. 8)	N-RGO/ Mn_3O_4	O_2	120	atm.	DMF	12	20	77	92.5	91.4
8 (Present study	CuO-CeO_2	O_2	130	atm.	DMF	12	50	200	95	100

[a] References given in the article. Temp. = Temperature, Pres. = Pressure, Cat. = catalyst, amnt. = Amount, VA = Vanillyl alcohol, Conv. = Conversion, Sel. = Selectivity, ACN = Acetonitrile, IPA = Iso-propyl alcohol, DMF = N, N-Dimethylformamide, atm. = Atmospheric, b = present work.