Supplementary Information

Hydrogenolysis of furfuryl alcohol over CuCeMgAl mixed metal oxide catalysts derived from layered double hydroxides

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Table of Contents

Figure S1. Cu 2p XPS spectra of unreduced catalysts.

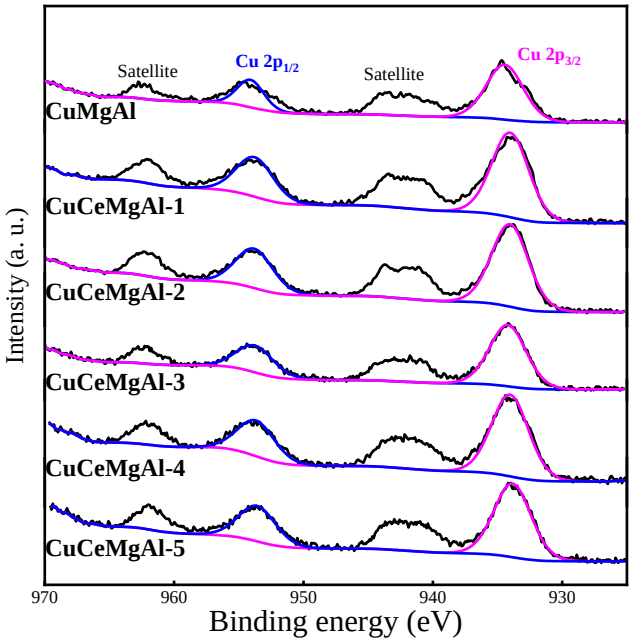

Figure S2. Ce 3d XPS spectra of unreduced catalysts.

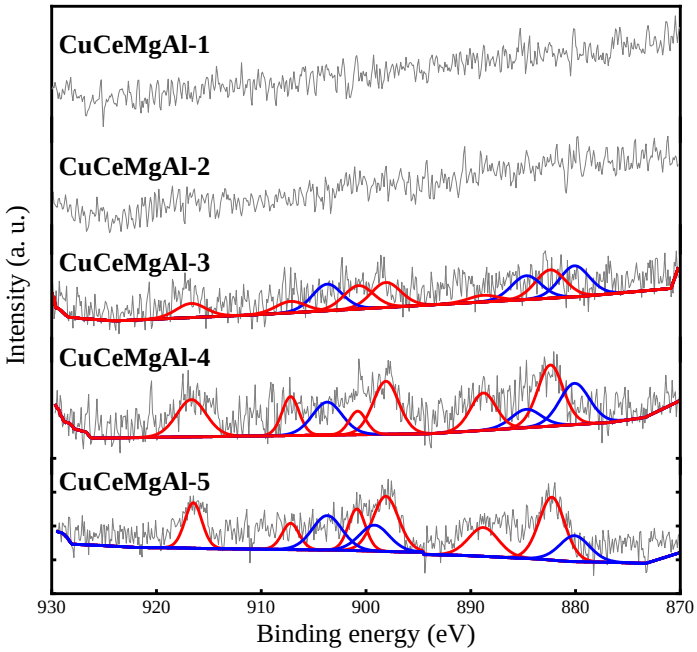

Figure S3. Cu LMM Spectra of CuMgAl and CuCeMgAl catalysts reduced at 550 °C for 3 h.

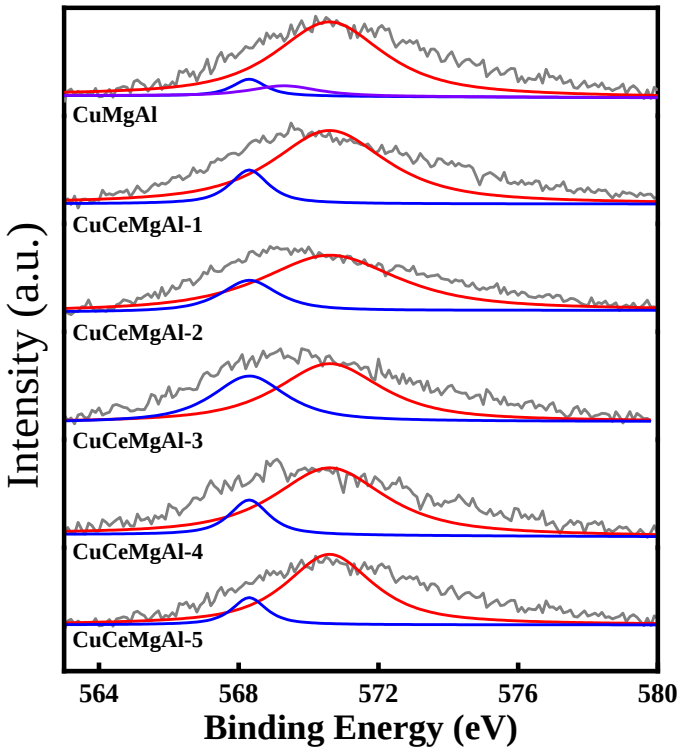

Figure S4. Ce 3d XPS spectra of CuCeMgAl-3 reduced at 350, 450, or 550 °C for 3 h.

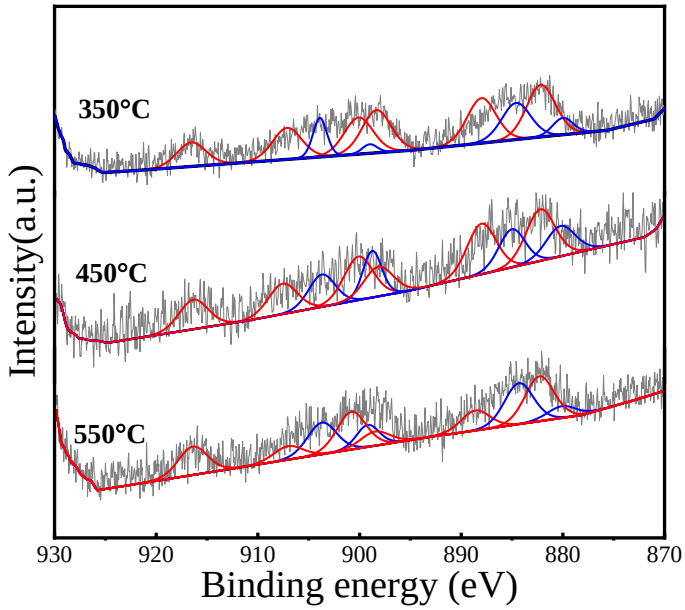

Figure S5. Cu 2p XPS spectra of CuCeMgAl-3 reduced at 350, 450, or 550 °C for 3 h.

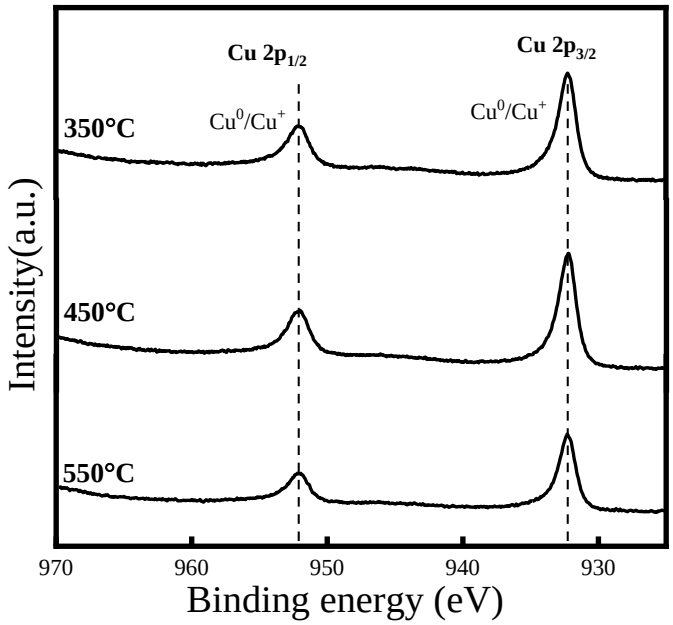

Table S1. Literature summary of reduction conditions and catalyst activity of Cu-based catalysts in furfuryl alcohol hydrogenolysis to pentanediols.[a]

No.	Catalyst	Reduction condition	Reaction condition	FFA conversion (%)	Pentanediol selectivity (%)		Reference
					1,2-PDO	1,5-PDO	
1	$CuO\text{-}Al_2O_3$	350°C, 3 h, 20% H_2-80% N_2, 40 mL/min	0.2 g active metal, 40 g 10 wt% FFA in ethanol, 140°C, 6 MPa H_2, 8 h	85.8	48.1	22.2	[1]
2	CuMgAl-LDO	350°C, 3 h, 20% H_2-80% N_2, 40 mL/min	0.40 g of Cu, 40 g of 10 wt% FFA in ethanol, 140°C, 6 MPa H_2, 8 h	63.1	50.0	30.5	[2]
3	Cu-Co-Al MMO	300~500°C, 1 h, H_2, 60 mL/min	0.5 g catalyst, 0.5 g FFA in 25 mL of ethanol, 140°C, 4 MPa H_2, 2 h	41.5	18.5	40.4	[3]
4	$Cu_{0.2}Co_{5.8}/Al_2O_3$	400°C, 1 h, 5% H_2/N_2	0.1 g catalyst, 0.5 g FFA in 19.5 g isopropanol, 140°C, 4 MPa H_2, 2 h	97.2	15.9	45.5	[4]
5	$CuLaCoO_3$	300°C, 3h, 5% H_2-95% N_2, 40 mL/min	0.15 g Cu, 30 g of 5 wt% FFA in ethanol, 140°C, 6 MPa H_2, 2 h	100	15.2	40.3	[5]
6	$Cu@MgO\text{-}La_2O_3$	450°C, 4 h, H_2, 150 mL/min	0.3 g catalyst, 1.5 g FFA in 28.5 g isopropanol, 140°C, 6 MPa H_2, 24 h	94.9	67.1	19.8	[6]
7	$Cu_{1.8}Mg_{1.2}Al$	300°C, 2 h, H_2	0.04 g catalyst, 0.2 g FFA in 3.8 g isopropanol, 140°C, 6 MPa H_2, 10 h	95.2	48.3	16.4	[7]
8	CuMgAlO	-	150 ℃, FFA in solvent alcohol, 6 MPa, 6 h	84.1	55.2	28.5	[8]
9	$Cu_{0.1}Co_{2.9}Al$	400℃, 1 h, H_2/N_2 (1:3)	0.1 g of catalyst, 0.5 g of FA in 40 g of ethanol, 140 ℃, 4 MPa, 6 h	100	10.0	41.1	[9]
10	$Al(OH)_3/Cu$	-	0.085 g of catalyst, 0.5 g of FFA in 2 mL of isopropanol, 170 ℃, 4.5 MPa, 6 h	90.8	37.1	-	[10]
11	CuCeMgAl MMO	350~550°C, 3 h, H_2, 40 mL/min	1 g of catalyst, 3 g of FFA in 25 mL of ethanol, 140 ℃, 4 MPa, 6 h	77.3	57.7	18.4	This work

[a] Abbreviations: FFA, furfuryl alcohol; FA, furfural; 1,2-PDO, 1,2-pentanediol; 1,5-PDO, 1,5-pentanediol.

Reference

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