Approaching to the characterization of monolithic catalysts based on La perovskite-like oxides and their application for VOC oxidation under simulated indoor environment conditions

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Tabla S1. Review about oxide-type materials used as catalysts for VOC oxidation.

Catalyst	Metal composition	VOC	VOC conversion	Oxidation temperature	Paper title
			[%]	[°C]	
CeO2	Ce	Trichloroethylene	50	160	Low-temperature catalytic combustion of trichloroethylene over cerium oxide and catalyst deactivation
CeO2	Ce	Trichloroethylene	50	425	Catalytic purification of waste gases containing VOC mixtures with Ce/Zr solid solutions
ZrO2	Zr	Trichloroethylene	50	440	Catalytic purification of waste gases containing VOC mixtures with Ce/Zr solid solutions
Ce0.5Zr0.5O2	Ce Zr	Trichloroethylene	50	390	Catalytic purification of waste gases containing VOC mixtures with Ce/Zr solid solutions
Ce0.15Zr0.85O2	Ce Zr	Trichloroethylene	50	385	Catalytic purification of waste gases containing VOC mixtures with Ce/Zr solid solutions
CeO2	Ce	Toluene	50	590	Catalytic combustion of volatile organic compounds on gold/cerium oxide catalysts
Au/CeO2	Au Ce	Toluene	50	260	Catalytic combustion of volatile organic compounds on gold/cerium oxide catalysts
Au/TiO2	Au Ti	n-Hexane	50	250	Investigation of the preparation and activity of gold catalysts in the total oxidation of n-hexane
Au/r-MnO2	Au Mn	n-Hexane	50	160	Investigation of the preparation and activity of gold catalysts in the total oxidation of n-hexane
Cr-Cu/SiCl4-Z	Cr Cu	Trichloroethylene	50	400	Combustion of chlorinated volatile organic compounds (VOCs) using bimetallic chromium-copper supported on modified H-ZSM-5 catalyst
MnO2	Mn	n-Hexane	50	190	Extent of the participation of lattice oxygen from g-MnO2 in VOCs total oxidation: Influence of the VOCs nature
Mn0,4Zr0,6O2	Mn Zr	Dichloroethylene	50	305	Structure of Mn–Zr mixed oxides catalysts and their catalytic performance in the gas-phase oxidation of chlorocarbons
Mn0,4Zr0,6O2	Mn Zr	Trichloroethylene	50	315	Structure of Mn–Zr mixed oxides catalysts and their catalytic performance in the gas-phase oxidation of chlorocarbons

Catalyst	Metal composition			VOC	VOC conversion	Oxidation temperature	Paper title
					[%]	[°C]	
Mn0,5-Ce0,5	Mn	Ce		Ethanol	50	190	VOC oxidation over MnOx–CeO2 catalysts prepared by a combustion method
Mn0,5-Ce0,6	Mn	Ce		Ethyl acetate	50	210	VOC oxidation over MnOx–CeO2 catalysts prepared by a combustion method
Mn9Cu1	Mn	Cu		Ethanol	50	192	Evaluation and characterization of Mn–Cu mixed oxide catalysts for ethanol total oxidation: Influence of copper content
LaFe0,7Ni0,3O3	Fe	Ni	La	Ethanol	50	220	Surface properties and performance for VOCs combustion of LaFe1 yNiyO3 perovskite oxides
LaFe0,7Ni0,3O3	Fe	Ni	La	Acetyl acetate	50	282	Surface properties and performance for VOCs combustion of LaFe1 yNiyO3 perovskite oxides
20%LaCoO3/Ce0,9Zr0,1O2	Co		La	Toluene	50	192	Ceria-based oxides as supports for LaCoO3 perovskite; catalysts for total oxidation of VOC
10%LaCoO3/Ce0,9Zr0,1O2	Co		La	Toluene	50	268	Ceria-based oxides as supports for LaCoO3 perovskite; catalysts for total oxidation of VOC
Ce0,9Zr0,1O2	Ce	Zr		Toluene	50	295	Ceria-based oxides as supports for LaCoO3 perovskite; catalysts for total oxidation of VOC
LaCoO3	Co		La	Toluene	50	244	Ceria-based oxides as supports for LaCoO3 perovskite; catalysts for total oxidation of VOC
Cr-PILC	Cr			Chlorobenzene	50	420	Catalytic oxidation of aromatic VOCs with Cr or Pd-impregnated Al-pillared bentonite: Byproduct formation and deactivation studies
Cr-PILC	Cr			Xylene	100	600	Catalytic oxidation of aromatic VOCs with Cr or Pd-impregnated Al-pillared bentonite: Byproduct formation and deactivation studies
Ag-HY	Ag			Butyl acetate	50	325	Catalytic oxidation of butyl acetate over silver-loaded zeolites
Ag-HZSM-5	Ag			Butyl Alcohol	50	350	Catalytic oxidation of butyl acetate over silver-loaded zeolites
Ag-HY	Ag			Toluene	100	290	Design of dual functional adsorbent/catalyst system for the control of VOC's by using metal-loaded hydrophobic Y-zeolites

Catalyst	Metal composition			VOC	VOC conversion	Oxidation temperature	Paper title	—
					[%]	[°C]		
Mn0,4Zr0,6O2	Mn	Zr		Toluene	98	280	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
Mn2O3	Mn			Toluene	98	280	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
Mn0,4Fe0,6	Fe	Mn		Toluene	98	300	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
Mn0,4Co0,6	Co	Mn		Toluene	98	270	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
Mn0,4Cu0,6	Cu	Mn		Toluene	98	240	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
Mn0,67Cu0,33	Mn	Cu		Toluene	98	220	Catalytic oxidation of toluene on Mn–containing mixed oxides prepared in reverse microemulsions	
LaMnO3	Mn		La	Benzene	50	301	Catalytic activity of LaMnO3and LaCoO3 perovskites towards VOCs combustion	
LaMnO3	Mn		La	Isopropanol	50	216	Catalytic activity of LaMnO3and LaCoO3 perovskites towards VOCs combustion	
LaMnO3	Mn		La	Acetone	50	203	Catalytic activity of LaMnO3and LaCoO3 perovskites towards VOCs combustion	
LaCoO3	Co		La	Toluene	50	163	Catalytic activity of nanometer La1xSrxCoO3(x = 0, 0.2) perovskites towards VOCs combustion	
LaCoO3	Co		La	Propyl alcohol	50	150	Catalytic activity of nanometer La1xSrxCoO3(x = 0, 0.2) perovskites towards VOCs combustion	
La0,8Sr0,2CoO3	Co		La, Sr	Toluene	50	160	Catalytic activity of nanometer La1xSrxCoO3(x = 0, 0.2) perovskites towards VOCs combustion	
La0,8Sr0,2CoO3	Co		La, Sr	Propyl alcohol	50	150	Catalytic activity of nanometer La1xSrxCoO3(x = 0, 0.2) perovskites towards VOCs combustion	
La0,9Ce0,1CoO3	Co		La, Ce	Methane	50	365	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation	

Catalyst	Metal composition			VOC	VOC conversion	Oxidation temperature	Paper title
					[%]	[°C]	
LaCoO3	Co		La	Methane	50	418	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation
LaFeO3	Fe		La	Methane	50	595	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation
La0,9Ce0,1CoO3	Co		La, Ce	Methanol	50	112	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation
LaCoO3	Co		La	Methanol	50	154	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation
LaFeO3	Fe		La	Methanol	50	209	Effects of iron and cerium in La1yCeyCo1xFexO3 perovskites as catalysts for VOC oxidation
Cu0,15Ce0,85	Ce	Cu		Ethyl acetate	50	223	VOC oxidation over CuO–CeO2 catalysts prepared by a combustion method
CuO	Cu			Ethyl acetate	50	278	VOC oxidation over CuO–CeO2 catalysts prepared by a combustion method
Cu0,15Ce0,85	Ce	Cu		Toluene	50	232	VOC oxidation over CuO–CeO2 catalysts prepared by a combustion method
CuO	Cu			Toluene	50	265	VOC oxidation over CuO–CeO2 catalysts prepared by a combustion method
Co4MnAl+K	Co	Mn	Al	Toluene	50	145	Modification of Co–Mn–Al mixed oxide with potassium and its effect on deep oxidation of VOC
LaMn0,25Co0,75O3	Co	Mn	La	2-propanol	50	165	Physical–chemical property and activity evaluation of LaB0.5Co0.5O 3 (B = Cr, Mn, Cu) and LaMnxCo1xO3(x = 0.1, 0.25, 0.5) nano perovskites in VOC combustion
CoMn/AC	Mn	Co		Toluene	50	232	Phenyl VOCs catalytic combustion on supported CoMn/AC oxide catalyst
CoMn/AC	Mn	Co		Ethyl benzene	50	238	Phenyl VOCs catalytic combustion on supported CoMn/AC oxide catalyst
Ce/Al-MSPs(50/25)	Ce		Al	Acetone	50	120	A comparative investigation on the low-temperature catalytic oxidation of acetone over porous aluminosilicate-supported cerium oxides

Catalyst	Metal composition		VOC	VOC conversion	Oxidation temperature	Paper title
				[%]	[°C]	
Co/M_Clay	Co		Propylene	50	302	Catalytic complete oxidation of acetylene and propene over clay versus cordierite honeycomb monoliths without and with chemical vapor deposited cobalt oxide
Co/M_Crd	Co		Propylene	50	363	Catalytic complete oxidation of acetylene and propene over clay versus cordierite honeycomb monoliths without and with chemical vapor deposited cobalt oxide
Cu0.3Ce0.7Ox	Ce	Cu	Toluene	50	187	Low-temperature removal of toluene and propanal over highly activemesoporous CuCeOxcatalysts synthesized via a simpleself-precipitation protocol
Cu0.3Ce0.7Ox	Ce	Cu	Propanal	50	172	Low-temperature removal of toluene and propanal over highly activemesoporous CuCeOxcatalysts synthesized via a simpleself-precipitation protocol
CuO/CX	Cu		Ethyl acetate	50	255	Exotemplated copper, cobalt, iron, lanthanum and nickel oxides for catalytic oxidation of ethyl acetate
NiO/CX	Ni		Ethyl acetate	50	255	Exotemplated copper, cobalt, iron, lanthanum and nickel oxides for catalytic oxidation of ethyl acetate
Fe2O3/CX	Fe		Ethyl acetate	50	280	Exotemplated copper, cobalt, iron, lanthanum and nickel oxides for catalytic oxidation of ethyl acetate
La2O3/CX	La		Ethyl acetate	50	290	Exotemplated copper, cobalt, iron, lanthanum and nickel oxides for catalytic oxidation of ethyl acetate
Co3O4/CX	Co		Ethyl acetate	50	233	Exotemplated copper, cobalt, iron, lanthanum and nickel oxides for catalytic oxidation of ethyl acetate
CeO2/CX	Ce		Ethyl acetate	50	255	Total oxidation of ethyl acetate, ethanol and toluene catalyzed by exotemplated manganese and cerium oxides loaded with gold
MnxOy/CX	Mn		Ethyl acetate	50	245	Total oxidation of ethyl acetate, ethanol and toluene catalyzed by exotemplated manganese and cerium oxides loaded with gold
La0.7Ca0.3MnO3	Mn	La, Ca	n-Hexane	50	265	La1−xCaxMnO3 perovskites as catalysts for total oxidation of volatile organic compounds

Catalyst	Metal composition			VOC	VOC conversion	Oxidation temperature	Paper title
					[%]	[°C]	
LaMnO3	Mn		La	Ethanol	50	176	La1−xCaxMnO3 perovskites as catalysts for total oxidation of volatile organic compounds
La0.6Sr0.4Co0.2Fe0.8O3	Fe	Co	La, Sr	Propane	50	325	Synthesis, characterization and catalytic performance of LSCF perovskite for VOC combustion
La0.6Sr0.4Co0.2Fe0.8O3	Fe	Co	La, Sr	Ethanol	50	200	Synthesis, characterization and catalytic performance of LSCF perovskite for VOC combustion
LaCoO3	Co		La	CH_2Cl_2	75	500	Study of the formation of LaMO3 (M = Co, Mn) perovskites by propionates precursors: application to the catalytic destruction of chlorinated VOCs
LaMnO3	Mn		La	CH_2Cl_2	98	500	Study of the formation of LaMO3 (M = Co, Mn) perovskites by propionates precursors: application to the catalytic destruction of chlorinated VOCs

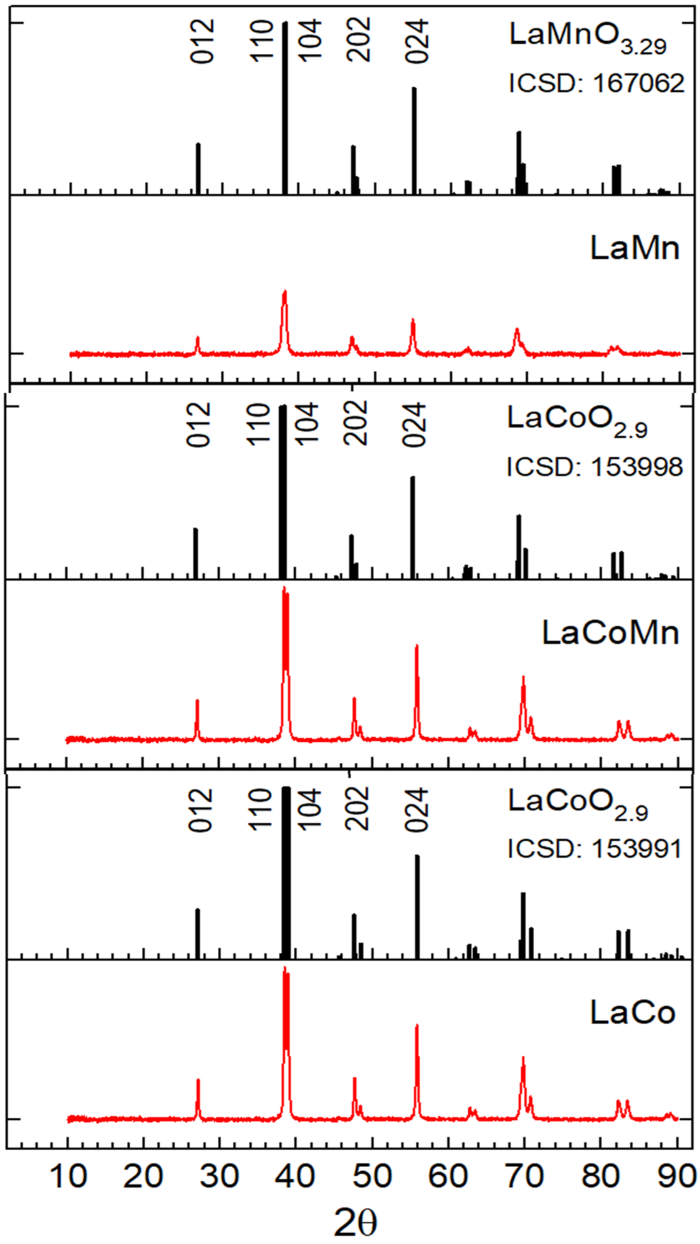

Figure S1. Comparison of diffractograms from the materials obtained and their matched ICSD reference profiles.

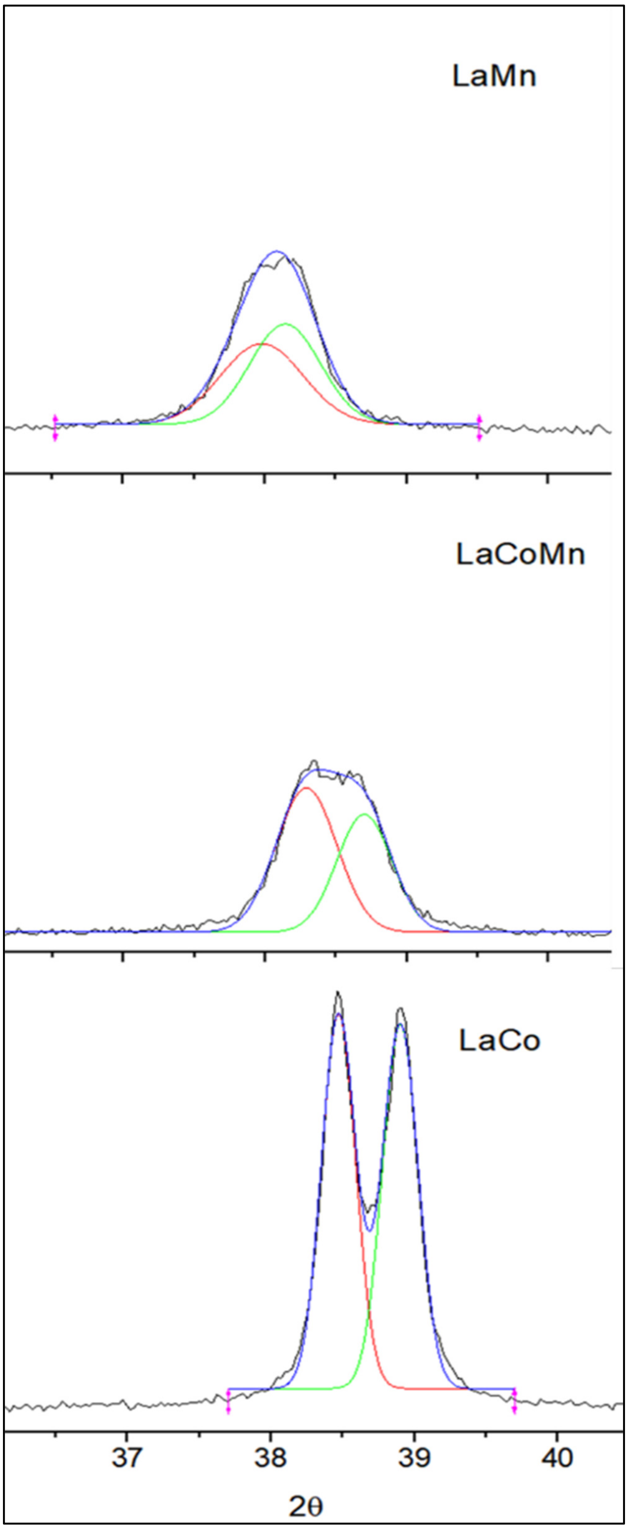

Figure S2. Deconvolution of peaks around 38° for analysis of crystallite size.

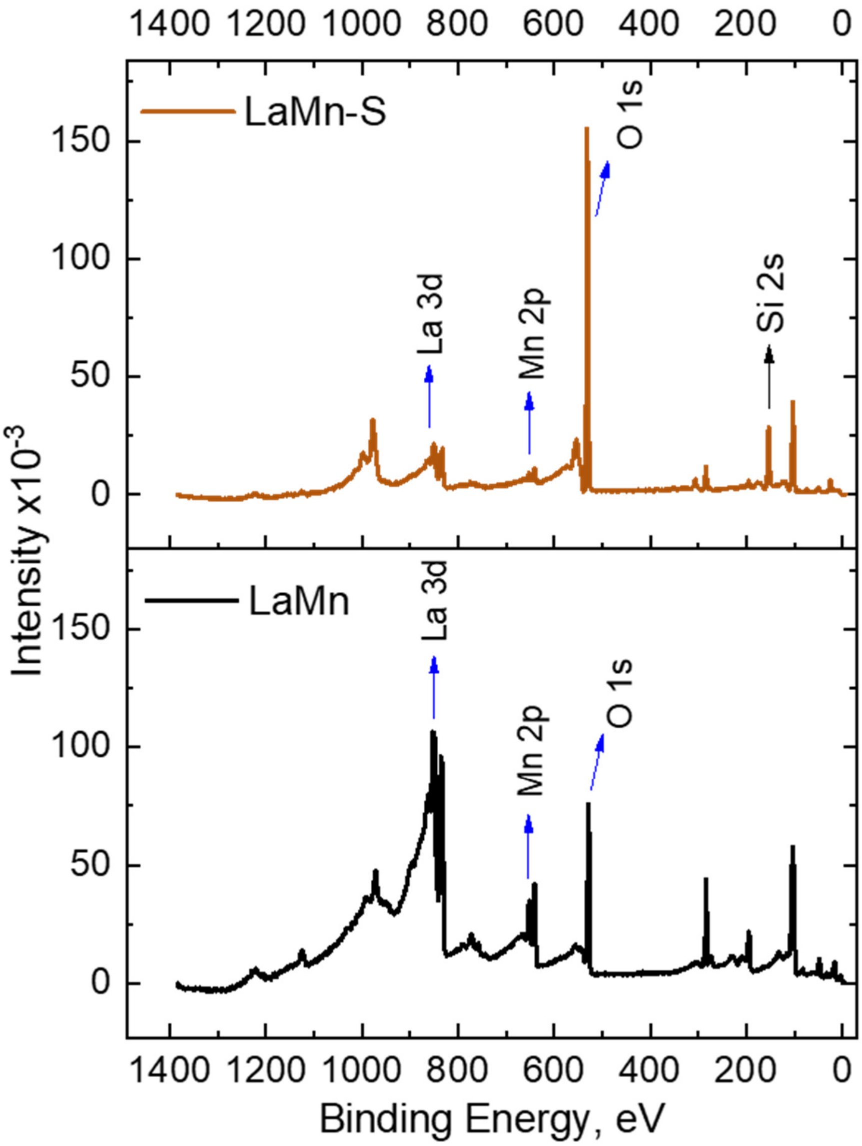

Figure S3. General XPS survey for powder (bottom) and monolithic La-Mn based catalysts (upper).

Table S2. High-resolution XPS for O 1s species in powder and monolithic catalysts.

System	O					
	OI		OII		OIII	
	BE (eV)	Atomic concentration (%)	BE (eV)	Atomic concentration (%)	BE (eV)	Atomic concentration (%)
LaCo	528.4	40.0	530.9	53.4	533.2	6.6
LaCo-S	528.5	3.3	530.5	26.7	532.3	70.0
LaCoMn	528.9	39.0	531.2	56.0	533.4	5.0
LaCoMn-S	528.9	1.2	531.4	32.3	532.6	66.5
LaMn	529.1	55.5	530.8	23.1	532.2	21.4
LaMn-S	529.2	7.2	531.3	27.3	532.1	65.5

ND: Not Detected

Table S 3. High-resolution XPS for La 3d species in powder and monolithic catalysts.

System	La			
	La I		La II	
	BE (eV) [3d 5/2 ; 3d 3/2]	Conc (%)	BE (eV) [3d 5/2 ; 3d 3/2]	Conc (%)
LaCo	[832.4 ; 849.3]	43.0	[834.4 ; 850.9]	57.0
LaCo-S	ND		[834.0 ; 850.7]	100
LaCoMn	[833.3 ; 850.1]	25.7	[834.6 ; 851.6]	74.3
LaCoMn-S	ND		[834.6 ; 851.3]	100
LaMn	[833.1 ; 849.9]	55.8	[834.7 ; 851.2]	44.2
LaMn-S	[833.3 ; 850.0]	100	ND	

ND: Not Detected

Table S 4. High-resolution XPS for Co 2p species in powder and monolithic catalysts.

System	Co			
	Co2+		Co3+	
	BE (eV) [2p 3/2 ; 2p 1/2]	Conc (%)	BE (eV) [2p 3/2 ; 2p 1/2]	Conc (%)
LaCo	[779.2 ; 794.2]	51.0	[780.7 ; 795.5]	49.0
LaCo-S	[778.9 ; 794.5]	30.5	[780.4 ; 796.3]	69.5
LaCoMn	[779.6 ; 794.8]	60.4	[780.9 ; 796.6]	39.6
LaCoMn-S	[779.7 ; ND]	30.8	[781.1 ; ND]	69.2

ND: Not Detected

Table S5. High-resolution XPS for Mn 2p species in powder and monolithic catalysts.

System	Mn			
	Mn3+		Mn4+	
	BE (eV) [2p 3/2 ; 2p 1/2]	Conc (%)	BE (eV) [2p 3/2 ; 2p 1/2]	Conc (%)
LaCoMn	[642.1 ; 653.6]	64.3	[644.8 ; 656.2]	35.7
LaCoMn-S	[641.5 ; ND]	79.6	[645.3 ; ND]	20.4
LaMn	[641.5 ; 653.1]	74.6	[644.3 ; 656.8]	25.4
LaMn-S	[641.0 ; ND]	71.4	[644.1 ; ND]	28.6

ND: Not Detected

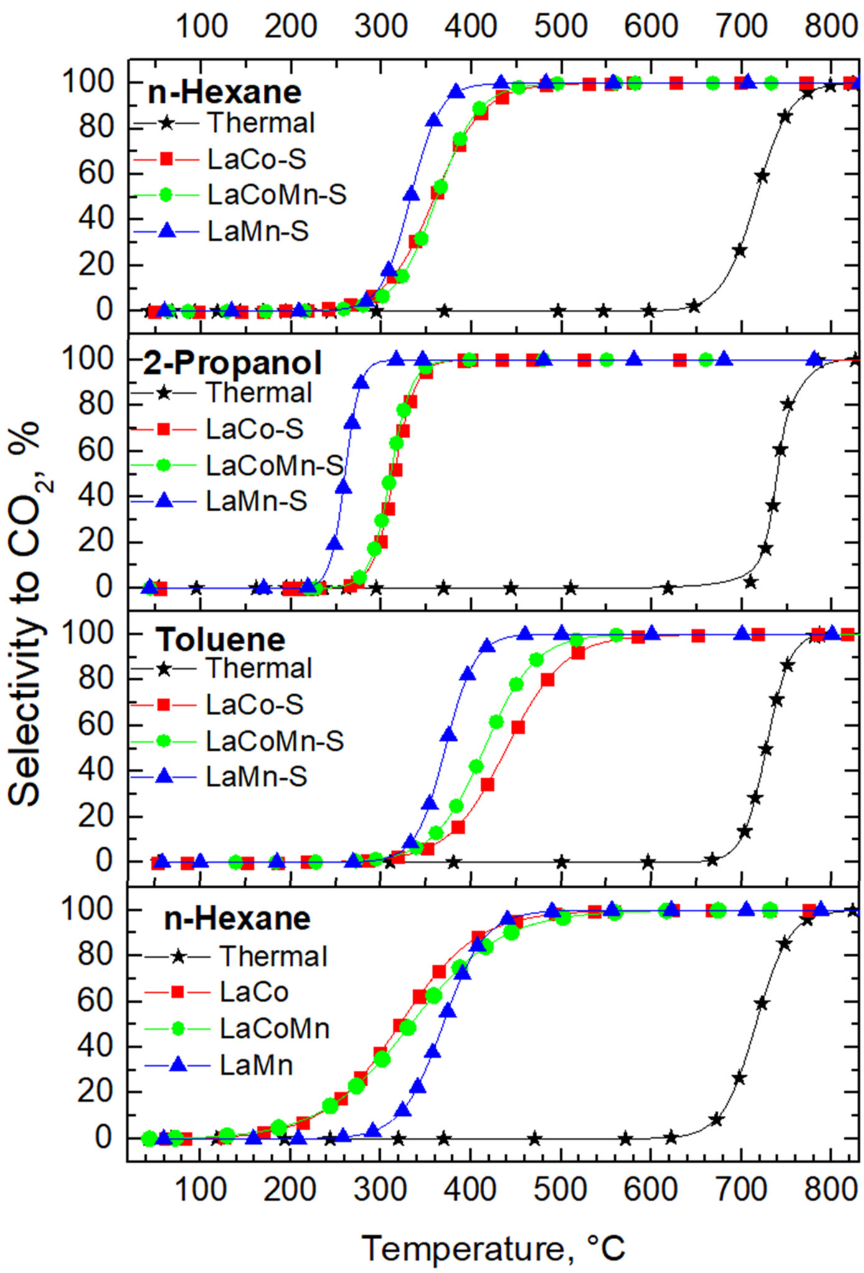

Figure S4. Comparative plot of n-hexane oxidation using powder catalysts and the oxidation of other VOC (n-hexane, 2-propanol, and toluene) using monolithic catalysts.