CATALYTICAL AND HEATING BEHAVIOR OF NANOSCALED PEROVSKITES UNDER MICROWAVE RADIATION

P. Scholz[2], J. Cihlar jr.[3], C. Möser[2], J. Cihlar[1], B. Ondruschka[2]

[1]Institute of Material Science and Engineering, Brno University of Technology, Technicka 2, 61669 Brno, Czech Republic
[2]Friedrich Schiller University Jena, Institute of Technical Chemistry and Environmental Chemistry, Lessingstr. 12, 07743 Jena, Germany
[3]Institute of Materials Chemistry, Brno University of Technology, 61669 Brno, Czech Republic

Perovskite powders of the type $La_{0.5}Ca_{0.5}Al_yM_{1-y}O_{3-\delta}$ (y = 0.25 to 0.5), M = Fe, Cr, Mn, Co, were prepared *via* sol–gel route according to modified Pechini method. The calcination of the resins at 350 °C in air was performed before final sintering at temperature 1000 °C for 6 hours. La, Ca, Fe, Al, Cr, Mn and Co contents in the solid were determined by microprobe attached to the electron microscope. The phase composition of the products was established by X-ray diffraction analysis, and the lattice parameters were calculated using the Rietveld analysis. The shape and size of particles were determined via scanning electron microscopy. The specific surface of powder perovskites was established by the BET method. Perovskites with Co and Cr content (y= 0.75) crystallized in rhomboedric structure with R3cH space group, perovskites with a medium Fe and Mn content in orthorhombic structure with Pbnm spatial group, and the perovskite with the lowest Fe content (y=0.5) in cubic structure with Pm3m space group. The primary particles were about 200 nm in size and formed agglomerates larger than 1.0 μm. The composition of perovskites as established by EDX analysis is given in Table 1.

Table 1. Chemical compositions and crystallographic data for the La-Ca-Al-M-O perovskites

Composition (input)	Composition (microanalysis)	Space group	Unit cell parameters (nm)			Crystalographic density (g/cm^3)
			a	b	c	
$La_{0,5}Ca_{0,5}Al_{0,5}Fe_{0,5}O_{3-\delta}$	$La_{0,53}Ca_{0,47}Al_{0,57}Fe_{0,43}O_{3-\delta}$	Pm3m	0.38288	0.38288	0.38288	4.96
$La_{0,5}Ca_{0,5}Al_{0,25}Fe_{0,75}O_{3-\delta}$	$La_{0,52}Ca_{0,48}Al_{0,27}Fe_{0,73}O_{3-\delta}$	Pbnm	0.54656	0.54631	0.77278	5.40
$La_{0,5}Ca_{0,5}Al_{0,25}Cr_{0,75}O_{3-\delta}$	$La_{0,54}Ca_{0,46}Al_{0,29}Cr_{0,71}O_{3-\delta}$	R3cH	0.53923	0.53923	1.32196	5.48
$La_{0,5}Ca_{0,5}Al_{0,25}Co_{0,75}O_{3-\delta}$	$La_{0,54}Ca_{0,46}Al_{0,29}Co_{0,71}O_{3-\delta}$	R3cH	0.54106	0.54106	1.30923	5.66
$La_{0,5}Ca_{0,5}Al_{0,25}Mn_{0,75}O_{3-\delta}$	$La_{0,53}Ca_{0,47}Al_{0,27}Mn_{0,73}O_{3-\delta}$	Pbnm	0.53903	0.53758	0.75728	5.61

For catalytical investigations we used the experimental set up which was published in [1]. The catalytic performance was measured in the most cases at atmospheric pressure with 3 g of catalyst with particle diameters between 200 nm and 1.0 μm placed on a silica frit (Por 2) in a fixed-bed quartz reactor (i. d. = 18 mm). The partial pressure of propane was 0.4 kPa with air as the carrier gas in all runs. Flow rates were controlled by electronic mass flow controllers (Tylan®, FC-260-2s). The flow rate was 0.4 L h^{-1} for propane, 100 L h^{-1} for air. First results show a strong dependency of catalytical and heating behavior on the nature of B-atom.

Conclusions and outlook. Nanoscaled perovskites of the type $La_{0.5}Ca_{0.5}Al_yM_{1-y}O_{3-\delta}$ (y = 0.25 to 0.5), M = Fe, Cr, Mn, Co are interesting materials for microwave-assisted heterogeneous gas phase catalysis. We could found a strong dependency between the catalytical and the heating behavior of the materials and the nature of B atom. Correlation between TPD and oxidation behavior of the materials has to be done in the next future.

[1] Will, H., Scholz, P., Ondruschka, B. „Heterogeneous gas-phase catalysis under microwave radiation-A new nmulti mode mirowave applicator“, Topics catal., 29 **(2004)**, 175.