

## Synthesis of nanostructured perovskite powders via simple carbonate co-precipitation

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A very simple, cost-effective, chloride- and alkali-free, carbonate co-precipitation synthesis in aqueous medium was applied in the preparation of perovskite-type lanthanum manganese oxide-based powders, i.e.  $\text{La}_{0.70}\text{Sr}_{0.30}\text{MnO}_{3-\delta}$  (LSM) and  $\text{La}_{0.75}\text{Sr}_{0.25}\text{Cr}_{0.5}\text{Mn}_{0.5}\text{O}_{3-\delta}$  (LSCrM). The precursors so obtained yielded nano-structured perovskite oxides when treated at 900°C and 800°C, respectively. The measured BET surface areas were in the low-end range for high temperature oxides ( $4\text{ m}^2\text{ g}^{-1}$  and  $10\text{ m}^2\text{ g}^{-1}$ ) but the X-ray crystallite size was as low as 50 nm for LSCrM and 90 nm for LSM.

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### Introduction

Perovskites (general formula  $\text{ABO}_3$ ) and, in particular, substituted perovskites have been extensively studied in view of their potential application in Intermediate Temperature Solid Oxide Fuel Cells (IT-SOFCs) as electrolyte, anode, and cathode materials (Hsu et al., 2006; Tao et al., 2005). Substituted perovskites have also been investigated for their catalytic activity in several reactions, as extensively reviewed some years ago (Peña & Fierro, 2001). Recently, great interest has arisen with regard to their relevance in the treatment of exhaust gases for automotive applications, as proposed by Kim et al. (2010). They demonstrated the possible replacement of the Pt-based catalyst in diesel oxidation (DOC) and lean  $\text{NO}_x$  trap (LNT) in favour of Sr-doped  $\text{LaMnO}_3$  and  $\text{LaCoO}_3$  perovskite-based catalysts. However, they admitted that replacement under the actual operating conditions remained challenging due to the necessary periodic exposure of the catalyst to a reducing envi-

ronment (during the regeneration/desulphation processes) which could cause degradation/decomposition of the perovskite oxide. In this respect, a possibly improved composition is proposed below.

The factors that affect the catalytic activity of perovskite oxides originate from their chemical composition, defects (anionic and cationic vacancies), and microstructure (especially their surface area). In this respect, one of the main challenges in obtaining perovskite oxide catalysts is development of the mixed-oxide phase while retaining a due number of active sites. The production of high quality perovskite nanopowders with adequate surface areas for them to be exploited as catalytic materials can be attained if the phase formation requires a low-temperature treatment that prevents grain growth. Mild chemical methods, such as liquid chemical synthesis, can be useful in controlling the composition and microstructure of the final material. The achievement of nanometric dimensions is highly dependent on the synthesis parameters, such as temperature, pH, the nature and concentra-

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