Introduction

An intensive research has been carried out in the last decade to find catalysts active for the abatement of diesel exhaust pollutants. The main contaminants emitted by this type of engine are nitrogen oxides and soot particles. The current tendency is to minimize NO production by high exhaust gas recirculation (EGR) rates and tackle the problem of high diesel particulate emissions with the combined use of traps and oxidation catalysts [1]. Diesel particulate filters (DPFs) based on wall-flow-type monoliths are generally recognized as the most viable solution to the related pollution problem [2]. Anyway, the uncontrolled catalytic regeneration of a DPF showed high emissions of CO and PM0.1 [3]. Since supported gold catalysts and perovskite catalysts show high catalytic activity towards CO oxidation [4] and soot combustion [5], respectively, the development of a multifunctional Au-perovskite catalyst for a controlled DPF regeneration was investigated with this work.

Materials and Methods

A series of perovskite catalysts (LaMnO₃, LaCrO₃, LaFeO₃, LaNiO₃) was prepared via a highly exothermic and self-sustaining reaction, the Solution Combustion Synthesis (SCS) method [6]. The Au-perovskite catalysts (Au-LaMnO₃, Au-LaCrO₃, Au-LaFeO₃, Au-LaNiO₃) were prepared via the same route, by adding HAuCl₄ to the precursors solution in order to obtain a catalyst with 2 wt% of gold. Characterization by FESEM-EDS, XRD and BET techniques was accomplished. The activity of the prepared catalysts was analysed by TPC, according to standard operating procedures reported in [5] for soot combustion and in [6] for CO oxidation, respectively. The LaNiO₃-2%Au catalyst was then deposited by in situ SCS directly over a SiC wall-flow filter and tested over real diesel exhaust gases with the procedure reported in [3].

Results and Discussion

The SCS method has been developed to produce in a low-cost “one-step” process, homogeneous, very fine, crystalline powders without the intermediate steps which other conventional synthesis routes would require. Such features were also interesting for the co-synthesis of the supported Au catalysts; actually it was possible to achieve in one-shot Au clusters of comparable size (5-10 nm) with those obtained by more complex controlled precipitation methods [4]. Figure 1a illustrates a FESEM picture of the LaNiO₃-2%Au catalyst. It regards the catalyst which showed the highest activity among those prepared. Some data regarding the catalyst characterization are listed in Table 1. The main contaminants emitted by this type of engine are nitrogen oxides and soot particles. The current tendency is to minimize NO production by high exhaust gas recirculation (EGR) rates and tackle the problem of high diesel particulate emissions with the combined use of traps and oxidation catalysts [1]. Diesel particulate filters (DPFs) based on wall-flow-type monoliths are generally recognized as the most viable solution to the related pollution problem [2]. Anyway, the uncontrolled catalytic regeneration of a DPF showed high emissions of CO and PM0.1 [3]. Since supported gold catalysts and perovskite catalysts show high catalytic activity towards CO oxidation [4] and soot combustion [5], respectively, the development of a multifunctional Au-perovskite catalyst for a controlled DPF regeneration was investigated with this work.

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