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$La_{0.8}Ba_{0.2}FeO_3$ Perovskite as an Additive in the Three-Way Catalyst (TWCs) for Reduction of PGMs Loading

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Abstract : Nowadays, air pollution has become a topic of great concern all over the world. One of the main sources of air pollution is automobile exhaust gas, which introduces a large number of toxic gases, including CO, unburned hydrocarbons (HCs), NOx, and non-methane hydrocarbons (NMHCs), into the air. The application of three-way catalysts (TWCs) is still the most effective strategy to mitigate the emission of these pollutants. Due to the stringent environmental regulations which continuously become stricter, studies on the TWCs are ongoing despite several years of research and development. This arises from the washcoat complexity and the several numbers of parameters involved in the redox reactions. The main objectives of these studies are the optimization of washcoat formulation and the investigation of different coating modes. Perovskite (ABO_3), as a promising class of materials, has unique features that make it versatile to use as an alternative to commonly mixed oxides in washcoats. High catalytic activity for oxidation reactions and its relatively high oxygen storage capacity are important properties of perovskites in catalytic applications. Herein, $La_{0.8}Ba_{0.2}FeO_3$ perovskite material was synthesized using the co-precipitation method and characterized by XRD, ICP, and BET analysis. The effect of synthesis conditions, including B site metal (Fe and Co), metal precursor concentration, and dopant (Ba), were examined on the phase purity of the products. The selected perovskite sample was used as one of the components in the TWC formulation to evaluate its catalytic performance through Light-off, oxygen storage capacity, and emission analysis. Results showed a remarkable increment in oxygen storage capacity and also revealed that T50 and emission of CO, HC, and NOx reduced in the presence of perovskite structure which approves the enhancement of catalytic performance for the new washcoat formulation. This study shows the brilliant future of advanced oxide structures in the TWCs.

Keywords : Perovskite, three-way catalyst, PGMs, PGMs reduction
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