

Editorial

Perovskite Catalysts—A Special Issue on Versatile Oxide Catalysts

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Perovskite-type catalysts have been prominent oxide catalysts for many years due to attributes such as flexibility in choosing cations, significant thermal stability, and the unique nature of lattice oxygen. Nearly 90% metallic elements of the Periodic Table can be stabilized in perovskite's crystalline framework [1]. Moreover, by following the Goldschmidt rule [2], the A- and/or B-site elements can be partially substituted, making perovskites extremely flexible in catalyst design. One successful example is the commercialization of noble metal-incorporated perovskites (e.g., $\text{LaFe}_{0.57}\text{Co}_{0.38}\text{Pd}_{0.05}\text{O}_3$) for automotive emission control used by Daihatsu Motor Co. Ltd. [3]. Thus, growing interest in, and application of perovskites in the fields of material sciences, heterogeneous catalysis, and energy storage have prompted this Special Issue on perovskite catalysts.

This issue includes one review and three articles. The review, contributed by Keav *et al.* [4], scrutinizes perovskites as three-way catalysts. Catalyst design by B-site element selection, noble metal incorporation, catalyst preparation and implementation of perovskites in three-way catalytic (TWC) convertors are particularly emphasized. Mirzababaei and Chuang [5] discovered that by coating a thin film (approximately 40 μm) of $\text{La}_{0.6}\text{Sr}_{0.4}\text{Co}_{0.2}\text{Fe}_{0.8}\text{O}_3$ perovskite on the surface of an Ni/YSZ anode, the stability of the anode increased significantly in a direct methane solid oxide fuel cell. Oxidation activities of methane and deposited carbon of the coated perovskite is therefore proposed. Mierwaldt *et al.* [6] studied the surface chemistry of $\text{Pr}_{1-x}\text{Ca}_x\text{MnO}_3$ ($x = 0, 0.3, 0.5, \text{ and } 0.8$) using *ex/in situ* XANES and XPS analyses. During oxygen evolution in electro-catalytic water splitting, the Mn ions can be reduced to a bivalent state as oxygen vacancies are formed on the surface of perovskite. They also discovered that the reduced surface can be transformed into its original state by adopting a low temperature (120 °C) annealing in an oxidative environment. Dos Santos *et al.* [7] used the

ethylenediaminetetraacetic acid-citric acid method to prepare monophasic crystalline $\text{LaNi}_{0.3}\text{Co}_{0.7}\text{O}_{3-\delta}$ and $\text{SrFe}_{0.2}\text{Co}_{0.8}\text{O}_{3-\delta}$, and investigated their performance in CO oxidation. The $\text{LaNi}_{0.3}\text{Co}_{0.7}\text{O}_{3-\delta}$ showed higher activity than $\text{SrFe}_{0.2}\text{Co}_{0.8}\text{O}_{3-\delta}$ at temperatures over 150 °C. The interactions between A and B site elements and their ionic radius most likely modified the CO oxidation behavior.

Indeed, these four publications are significant contributions to the research community, and reveal future opportunities for further research on perovskites. We appreciate the efforts taken by the aforementioned groups.

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