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Abstract

Oxygen reduction and evolution reactions occur on the same electrode in metal-air batteries and in unitized reversible fuel cells. Bifunctional oxygen electrodes should be able to perform both reactions with good chemical stability over a wide range of potentials. Perovskites are recognized for their good activity towards the oxygen evolution reaction. In this work, a $La_{0.6}Sr_{0.4}Fe_{0.8}Co_{0.2}O_3$ perovskite (LSFCO) is proposed and investigated for operation as both oxygen reduction and evolution catalyst in an aqueous alkaline solution. In order to improve the conductivity of the electrode, LSFCO is mixed with a high surface area conductive carbon black. The so-obtained catalyst is investigated in a half-cell by using a three-electrode configuration, in a KOH solution at ambient temperature, and compared to a Pd/C catalyst. Thinking of a possible use in a rechargeable metal-air battery operating in aqueous media (such as Fe-air, Zn-air, etc), LSFCO has been subjected to charge-discharge cycles at high current density. Results have proved that although LSFCO is less active than Pd/C for the oxygen reduction reaction, it is significantly more active for the oxygen evolution reaction. Besides, the LSFCO-based catalyst shows enhanced stability when subjected to charge-discharge cycles. The low cost of the perovskite and a good compromise between activity and stability, makes it a promising catalyst for electrochemical devices requiring bifunctionality.

Keywords: perovskite; oxygen reduction; oxygen evolution; alkaline media