

Bifunctional Catalysts for Oxygen Reduction and Evolution  
Reactions and Rechargeable Metal Air Batteries Using the Same

**Abstract**

The present disclosure relates to a bifunctional catalyst that is active for both oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) for a metal air battery or fuel cell. Said catalyst comprising a mixed metal oxide consisting of at least one lanthanide element and at least two different transition metal elements. The catalyst may further comprise a conducting additive. As an example, nanostructured perovskite bifunctional catalysts comprising La, Co and Mn ( $\text{LaCo}_{1-x}\text{Mn}_x\text{O}_3$ , LCMO) are synthesized by hydrothermal methods. The electrocatalytic activity of LCMO is significantly improved by the addition of conductive materials such as carbon nanotube. To demonstrate the practical utilization, LCMO in the composition of  $\text{LaCo}_{0.8}\text{Mn}_{0.2}\text{O}_3$  is used as air cathode catalysts for rechargeable zinc-air batteries.

(no suitable figure)