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# Multiple hollow CeO<sub>2</sub> spheres decorated MnO<sub>2</sub> microflower as an efficient catalyst for oxygen reduction reaction

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## Abstract

Herein, novel multiple hollow CeO<sub>2</sub> spheres decorated nanosheet-assembled MnO<sub>2</sub> microflower as an electrocatalyst towards oxygen reduction reaction (ORR) was successfully synthesized through a two-step hydrothermal approach. It is surprising to find that this composite with unique architecture exhibits a superior ORR catalytic activity than that of flower-like MnO<sub>2</sub> and hollow CeO<sub>2</sub> spheres monomers. The ORR catalytic activity is also comparable to that of 20 wt% Pt/C. The excellent electrocatalytic performance for ORR attributes to the synergistic effect between the hollow CeO<sub>2</sub> spheres and hierarchical nanosheet-assembled MnO<sub>2</sub>.

**Keywords:** CeO<sub>2</sub>/MnO<sub>2</sub>; catalyst; ORR; energy storage and conversion; functional.

## 1. Introduction

Electrochemical oxygen reduction reaction (ORR) plays a very important role in fuel cells and metal-air batteries [1]. However, the sluggish kinetics for ORR restrain the development of this kind of energy conversion devices [2]. With an aim to replace high-priced Pt-based noble metals for ORR catalysts, extensive endeavors have been poured to explore desirable nonprecious electrocatalysts with low cost, high ORR activity and good durability [3, 4].

Manganese dioxide (MnO<sub>2</sub>), as one of the most common transition metal oxides, has been investigated to be the prominent candidate for ORR catalyst and becomes a keen interest for

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