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BATTERIES & SUPERCAPS
Cover Profile

Bifunctional Oxygen Electrocatalysts for Lithium-Oxygen Batteries


Youngjoon Bae


Hyeokjun Park


Youngmin Ko


Hyunah Kim


Kisuk Kang

Department of Materials Science and Engineering
Seoul National University (Republic of Korea) http://energylab.snu.ac.kr/.

The front cover artwork is provided by the group of Prof. Kisuk Kang at the Materials Science and Engineering of Seoul National University. The image shows that the bifunctional catalyst (tunnel) lowers the polarization (congested roads) which occurs in both the oxygen reduction reaction (ORR) and the oxygen evolution reaction (OER) during Li-O_2 battery operation. Read the full text of the Minireview at 10.1002/batt.201800127.

What prompted you to investigate this topic/problem?

As one of the most promising candidates for next-generation batteries, Li-O_2 batteries have attracted considerable attention due to much higher energy densities than current Li-ion batteries. In Li-O_2 battery operation, an ORR occurs during discharging and an OER occurs during the charging reaction. In aqueous electrolyte, both reactions show sluggish kinetics and large polarizations due to the proton-coupled 4-electron transfer processes, which lowers the energy efficiency. Also, the low electrical conductivity of the discharge product (Li_2O_2) and the formation of by-products increases the polarization in non-aqueous electrolyte. Therefore, bifunctional catalysts to enhance both ORR and OER are necessarily required for the realization of the aqueous and non-aqueous Li-O_2 batteries.

What is the most significant result of this study?

In this paper, we present a brief overview of the bifunctional oxygen electrocatalysts reported for Li-O_2 batteries both in aqueous and non-aqueous electrolytes. The terms of the reactions are the same (ORR and OER), but the conditions, products and mechanisms are indeed quite different in aqueous and non-aqueous solutions. Therefore, we clearly explained the differences in mechanism and products of the ORR and OER in each electrolyte. Furthermore, we present a design prospect for an efficient bifunctional catalyst for future Li-O_2 batteries.

What other topics are you working on at the moment?

In addition to Li-O_2 batteries, our research is underway on various metal-air based batteries such as Na-O_2, Zn-air, and Li-SO_2. We have been also working on the water splitting catalysts related to OER.

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