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| Title: | Emerging Materials in Heterogeneous Electrocatalysis Involving Oxygen for Energy Harvesting |
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| Keywords: | bifunctional catalysts<br>electrocatalysis<br>heterogeneous catalysis<br>oxygen reduction reaction<br>oxygen evolution reaction |
| Issue Date: | 2018 |
| Publisher: | American Chemical Society |
| Citation: | ACS Applied Materials and Interfaces, 10(40), pp. 33737-33767 |
| Abstract: | Water-based renewable energy cycle involved in water splitting, fuel cells, and metal-air batteries has been gaining increasing attention for sustainable generation and storage of energy. The major challenges in these technologies arise due to the poor kinetics of the oxygen reduction reaction (ORR) and the oxygen evolution reactions (OER), besides the high cost of the catalysts. Attempts to address these issues have led to the development of many novel and inexpensive catalysts as well as newer mechanistic insights, particularly so in the last three-four years when more catalysts have been investigated than ever before. With the growing emphasis on bifunctionality, that is, materials that can facilitate both reduction and evolution of oxygen, this review is intended to discuss all major families of ORR, OER, and bifunctional catalysts such as metals, alloys, oxides, other chalcogenides, pnictides, and metal-free materials developed during this period in a single platform, while also directing the readers to specific and detailed review articles dealing with each family. In addition, each section highlights the latest theoretical and experimental insights that may further improve ORR/OER performances. The bifunctional catalysts being sufficiently new, no consensus appears to have emerged about the efficiencies. Therefore, a statistical analysis of their performances by considering nearly all literature reports that have appeared in this period is presented. The current challenges in rational design of these catalysts as well as probable strategies to improve their performances are presented. |
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