Handbook of Nanomaterials and Nanocomposites for Energy and Environmental Applications

The systematic breakdown of the oxygen reduction reaction and its current and future electrochemical application in fuel cell and battery technologies

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The ORR is a simple yet highly efficient half-reaction that forms the basis of many current and future energy generation and storage methods. From the ATP cycle that powers our cells to the fuel cell and battery technology that will power the future, the oxygen reduction reaction (ORR) plays a pivotal role in their operation. The oxygen reduction reaction refers to a set of half reactions, part of the paired redox reactions, in which oxygen gas (O2) is reduced to water (H2O) or hydrogen peroxide (H2O2). The product depends on the reaction medium and the reaction pathway taken. This book chapter will systematically break down the oxygen reduction reaction to give an understanding of the reaction mechanics and kinetics. The purpose of this paper is to share information on the application of the oxygen reduction reaction in energy generation and energy storage and to provide an overview of current trends in research and development to improve reaction kinetics.