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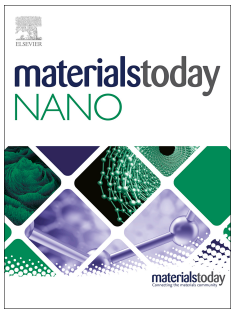

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Keywords: Palladium; electrocatalysts; hydrogen evolution/oxidation reaction; oxygen reduction reaction; liquid fuels oxidation reaction.

Abstract:
Replacing Pt with Pd as the electrocatalytic materials is essential to address the technical barriers of unaffordable Pt usage in numerous renewable energy technologies, such as fuel cells, metal-air batteries and water electrolyzers. In the past decades, both theoretical and experimental progresses have been made in advancing the Pd-based nanocatalysts, leading to catalytic activity comparable to or even exceeding that of Pt. In the present review, we overview the recently important breakthroughs in the development of promising Pd-based nanoelectrocatalysts. We begin with the brief introduction of current knowledge in fundamental electrocatalytic behavior of Pd-based electrodes and some reaction mechanism, aiming to rationalize the general guidelines of structural design for more promising nanocatalysts. Then, we demonstrate the representative examples of high-performance Pd-based nanoelectrocatalysts in terms of catalytic reactions, including hydrogen evolution/oxidation reaction, oxygen reduction reaction and liquid fuels oxidation reaction. Finally, we provide a short conclusion as well as personal perspective in this research field.

1. Introduction

Energy generation and conversion represents the essential processes in renewable energy innovations based on electrochemistry, which aims to solve the global crisis of energy shortage and environmental pollution [1-3]. Lying at the heart of these processes is a phenomenon called electrocatalysis, the efficiency of which critically relies on the applied electrocatalytic nanomaterials [4,5]. Due to its unique chemical, physical and electronic properties, platinum (Pt) seems to be the natural choice for catalyzing a wide range of reactions that are associated with the renewable energy technologies, such as fuel cells, metal-air batteries, water electrolyzers and so