Title:	Advances and Challenges in Pt-free Pd-based Catalysts for Oxygen Electro-Reduction in Alkaline Media
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Abstract:	The development of Pt-free efficient electrocatalysts for oxygen reduction reaction (ORR) is one of the major challenges for the wider adoption of fuel cell technology due to the exorbitant cost of Pt. Pd-based nanostructured electrocatalysts exhibit superior ORR activities in an alkaline medium used in the potentially more advantageous anion-exchange membrane fuel cells (AEMFCs). This has motivated researchers to devote tremendous efforts to construct innovative Pd-based nanostructures using a variety of emerging strategies for achieving high catalytic activity and stability. Herein, we discussed the advantages of AEMFCs over the more common proton-exchange membrane fuel cells (PEMFCs) that rely on Pt-based catalysts on the basis of the reaction mechanism and operational difficulties, and then go on to summarize the recent developments in Pd-based electrocatalysts for alkaline ORR. The effect of the shape of the nanostructures, alloy formation with metals and non-metals, atom ordering within lattice or in domains, and the role of the supporting materials in enhancing ORR activities have been described by citing key examples from the recent literature. Progress in achieving long-term stability while maintaining a high ORR efficiency while utilizing these Pd-based electrocatalysts have also been discussed that are based on several technically diverse strategies. We conclude by presenting a brief perspective on the challenges remaining in meeting the DOE-USA 2020 requirements, potential remedies, and the future research directions for using Pd-based electrocatalysts.
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