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An ultrafast oxygen evolution reaction catalyzed by an amorphous Nickel–Dysprosium-based electrocatalyst with extraordinary spatial morphology

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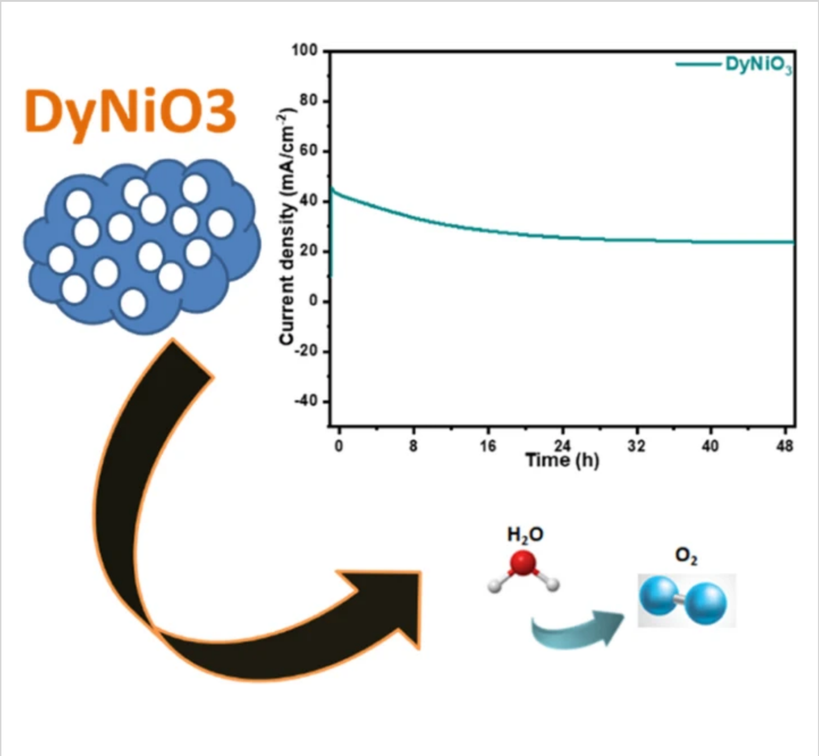
Abstract

Oxygen evolution reaction (OER) during water splitting majorly based on the structure and nature of the electrocatalyst. Perovskite oxides (ABO_3)

from the perovskite matrix are leached away from the A site. One of the most challenging problems is gaining enormous active amorphous subjects from cations in the B site rather than simply dissolving cations in the A site. In the present study, the crystalline perovskite ($DyNiO_3$) has been fabricated, which is converted into an amorphous nanostructured comparative to NiO, and characterized via numerous analytical characterization methods to investigate the structural, morphological, and textural characteristics. The designed substance is then investigated for electrochemical characterizations to evaluate the overpotential, Tafel slope, and durability. Among all, $DyNiO_3$ responses have a slight overpotential (η) of 265 mV and a low Tafel slope of 78 mV/dec with greater durability of 49 h. The efficient outcomes of the $DyNiO_3$ are because of the grater valence state of Ni^{3+} containing edge splitting octahedral-frameworks, which are bordering by interstitial deformed octahedral Dy^{3+} ion. This research improves perovskite oxides function as catalysts and can be applied to developing enhanced OER electrocatalysts and other energy applications in the near future.

Graphical Abstract



Highlights

- The $DyNiO_3$ was fabricated via simple hydrothermal method.
- The fabricated material is characterized via numerous analytical characterization.
- The designed substance is then investigated for electrochemical characterizations to evaluate the overpotential, Tafel slope and durability.
- The $DyNiO_3$ responses a low overpotential of 265 mV and a low Tafel slope of 78 mV/dec

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Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Contributions

SA, SM, AGA, MUN: Worked in the laboratory i.e., experimental work done and also wrote the manuscript, development or design of methodology; creation of models, RYK: Visualization. MA, MMA, SAMA: Writing, review, and editing. HMTF: Supervision.

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Ethics declarations

Conflict of interest

The authors declare no competing interests.

Ethical approval

Yes this article compliance with ethical standards of journal.

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