

Accepted Manuscript

Title: Identifying the forefront of electrocatalytic oxygen evolution reaction: electronic double layer

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PII: S0926-3373(18)30768-9
DOI: <https://doi.org/10.1016/j.apcatb.2018.08.037>
Reference: APCATB 16937

To appear in: *Applied Catalysis B: Environmental*

Received date: 10-4-2018
Revised date: 8-8-2018
Accepted date: 15-8-2018



Please cite this article as: Li G, Chuang P-YaA, Identifying the forefront of electrocatalytic oxygen evolution reaction: electronic double layer, *Applied Catalysis B: Environmental* (2018), <https://doi.org/10.1016/j.apcatb.2018.08.037>

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Identifying the forefront of electrocatalytic oxygen evolution reaction: electronic double layer

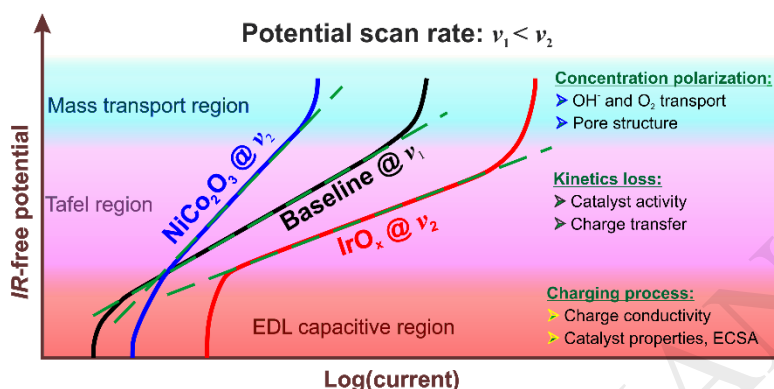
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Graphical Abstract



Highlights

- Opposite effect of scan rate on oxygen evolution for IrO_x and NiCo_2O_3 .
- Catalyst performance dependence on interfacial capacitance and reconstruction.
- Establishing relationship between oxygen evolution and electronic double layer.

Abstract

Developing a fundamental understanding of oxygen evolution reactions (OER) is essential to advancing state-of-the-art energy conversion and storage technologies such as electrolysis. However, it is extremely difficult to directly observe the forefront of the reaction interface, i.e. the electronic double layer (EDL). Herein, electrochemical diagnostic tools are developed to study interfacial behaviors during alkaline OER. Using the traditional linear sweep voltammetry method, we observe that increasing the potential scan rate improves the performance of amorphous Ir oxides, while, for cubic NiCo_2O_3 with higher mass-transport resistance, the effect of scan rate is reversed. The results further confirm that the EDL capacitive and pseudocapacitive processes have a significant impact on electrocatalytic OER. Moreover, continuous EDL reconstruction is observed from double-potential-step chronoamperometry. This reconstruction, mainly caused by chemical phase modification, has a positive influence on OER performance for the Ni-Co oxide, but a negative influence for the Ir oxide. By studying EDL effects, our findings open up new strategies to design promising catalysts and elucidate OER mechanisms.

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