

Engineering Defects in Electrocatalysts through Phase Transformations

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Reactant

Product

Intermediate

e^-

WE CE RE

WE

$M^{x+} \leftrightarrow M^{y+}$

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Developing electrocatalysts through phase transformations with a focus on understanding the relationship between defect structures and catalytic properties

Engineering Defects

Enhanced e^- transfer

Enhanced mass transfer

Uncoordinated active sites

Modulated electronic structure

■ Research

My goal is to explore the unique properties and hidden functionalities of materials. This includes modulating the intrinsic catalytic activity of electrocatalysts used in electrolyzers for green hydrogen, ammonia, and oxygen evolution reactions. The efficiency of electrolyzers is generally limited by the slow kinetics of these reactions, making it essential to develop electrocatalysts that are both active and chemically stable. Although defect engineering has shown promise, the relationship between structure and catalytic behavior remains poorly understood, limiting the rational design of electrocatalysts. This arises from challenges in controlling material structures and defect types through conventional methods, as well as the need for advanced characterization techniques. To address this, I aim to develop new strategies for defect generation and structural design. Through in-depth characterization, I seek to establish correlations among structure, defect chemistry, and catalytic behavior, while also investigating catalytic mechanisms to gain fundamental insights into reaction pathways and active sites.

■ Comments

I decided to join ICYS to pursue my research direction driven by interests and curiosity. Encouraged by my former supervisor to consider whether to be a leader or follower in research, I am motivated to apply to ICYS and take on the challenge of being independent, working on my research interests. This opportunity allows me to design a project, manage a budget, and grow as a researcher. ICYS provides strong support for this development, including access to advanced equipment, research funding, a mentoring system, and collaborative environments. I see this as an ideal step in preparing for the next stage of my research career.

■ Link

<https://www.nims.go.jp/icys/research/#KOSASANG>