Contribution ID: **143** Type: **Poster Presentation**

Bubble Dynamics on Hierarchical Porous Nickel Phosphide Electrode for Electrocatalytic Water Splitting

Monday, 30 May 2022 15:10 (1h 10m)

The hydrogen/oxygen evolution reaction (HER/OER) has been well-studied for design and synthesis of efficient electrocatalysts. To further enhance electrode performance, the hierarchical porous architecture is used to obtain large surface area and efficient mass transport. Recent studies were performed to reveal the impact of porous/mesh electrode surface wettability on bubble dynamics, which governs the overall interfacial mass transport during gas-evolving reactions and the associated overpotential. In fact, the quantitative relationship between the electrochemical process and bubble dynamics on porous electrodes is still unclear due to the sophisticated structure and difficulty in imaging bubbles at microscale. Here, we report the bubble dynamics and overpotential loss on hierarchical porous nickel phosphide electrode during electrocatalytic water splitting. The three-dimensional hierarchical structure of porous Ni5P4 powder coated Ni foam (p-Ni5P4@Ni) includes nano-pores ranging from 50-500 nm (from porous Ni5P4 powder) and micro-pores ranging from 200-600 µm (from Ni foam), and this porous structure is able to achieve outstanding catalytic performance with an overpotential of 145 mV for HER and 197 mV for OER at 10 mA/cm2. Our high-speed imaging results on p-Ni5P4@Ni show that the bubble departure size is about 10-50 micron, and the bubble number density and departure frequency increase linearly with the current density. Nano-pores of Ni5P4 provide abundant cavities to H2 bubble nucleation and subsequent inertia-controlled growth, especially under high current densities. This is totally different from H2 bubbles, nucleating and growing in a diffusion-controlled mode, on smooth surface of macro pores of clean Ni foam. For our porous Ni5P4@Ni electrodes, both the low transport and intrinsic overpotential contribute to the exceptional electrocatalytic performance.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

United Arab Emirates

References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

In person

Primary authors: Ms YUAN, Lin (Khalifa University of Science and Technology); Dr LU, Xinnan (Khalifa University of Science and Technology); Dr LALWANI, Shubra (Khalifa University of Science and Technology); Prof. ALMARZOOQI, Faisal (Khalifa University of Science and Technology); Prof. ZHANG, TieJun (Khalifa University of Science and Technology)

Presenter: Ms YUAN, Lin (Khalifa University of Science and Technology)

Session Classification: Poster

Track Classification: (MS19) Electrochemical processes in porous media