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Investigating the Influence of Amorphous/Crystalline IrOx on Performance and Degradation Mechanism for Proton Exchange Membrane Electrolyzer Cells (PEMECs)

Hydrogen (H2) with the sustainable and environmentally-benign H2/water cycle has been considered as the candidates for the next-generation clean energy vehicles. PEMECs have advantages of high efficiency, compact design, and near-zero emissions, making it attract unprecedented attention and have been regarded as the more promising water electrolysis technology in the future. Iridium oxides (IrOx) is a leading catalyst for the oxygen evolution reaction (OER) due to its high efficiency and corrosion resistance, However, the mechanisms responsible for its performance loss, dissolution, and degradation, especially those related to structural transition states, are still poorly understood. To investigate this, we used the cutting-edge optical photothermal infrared (O-PTIR) to characterize the structure of the electrodeposited IrOx under various conditions. we focuses on investigating the structural transition from amorphous to crystalline IrOx influence on OER performance and degradation mechanism in PEMECs by using O-PTIR. Our results have demonstrated that the structure of IrOx can transit under different conditions and that the OER performance varies with different IrOx structures: (1) the annealing temperature influences the structure of IrOx, transforming it from amorphous to crystalline as the temperature increases; (2) electrochemical activation induces a structural transition from amorphous to semi-crystalline (partially amorphous, partially crystalline). This work provides new insights into foundational knowledge for IrOx structures for highly efficient PEMECs.

Topical Area

Hard matter: energy materials

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