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Nanoscale Design of Hybrid Electrocatalysts for Sustainable Hydrogen Production

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Abstract Developing highly active and stable electrocatalysts for water splitting process is a key technology enabling effective renewable energy storage and conversion. Hybrid catalysts consisting of a metal (oxide) surface on a different metal (oxide) support provide a new approach for designing active and stable catalysts for both oxygen evolution reaction (OER) and hydrogen evolution reaction (HER). The following strategy has been applied in Dr. Lee's research: 1) designing nanoscale hybrid catalysts using various nano-processing techniques, 2) understanding the bulk and surface, atomic and electronic structures of electrocatalysts, 3) correlating these electrocatalysts' structures with electrocatalytic performances under operating conditions. In this presentation, we will introduce our recent studies on 1) hybrid catalysts designed through the in situ exsolution process of metallic nanoparticles on a B-site Ni-substituted lead ruthenate pyrochlore oxide to improve water-splitting process in alkaline medium and 2) the structural evolution and corresponding OER activity changes of model Ir nanocrystals with flat and concave surfaces under acidic conditions.

Keyword(s)
Electrocatalysis, Hybrid catalysts, Hydrogen evolution reaction, Oxygen evolution reaction, Water-Electrolyzers

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