Reducing the Barrier Energy of Self-Reconstruction for Anchored Nickel Nanoparticles as Highly Active Oxygen Evolution Electrocatalyst

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A new class of heterogeneous OER electrocatalyst (metallic Ni nanoparticles anchored on lead ruthenate pyrochlore oxide) is provided for securing fast OER kinetics. In situ X-ray absorption spectroscopy (in situ XAS) reveals that fast OER kinetics can be achieved by the harmonious catalytic synergy of a pyrochlore oxide support to Ni nanoparticles. By the facile oxidation of lead (A-site) and ruthenium (B-site) cations, the pyrochlore oxide support helps to expel the electrons generated from the catalytic behavior of Ni to the inner layers of the support, facilitating the electrostatic adsorption of OH^- ions and reducing the barrier energy for the formation of NiOOH intermediates. This work affords the rational design of transition metal nanoparticles anchored on pyrochlore oxide heterogeneous catalysts and the fundamental insight of catalytic origin associated with self-reconstruction of OER electrocatalysts.