

Ni-Core Complexes for Stable Oxygen Evolution Reaction

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Hydrogen evolution by electrochemical water splitting is a promising method for getting renewable energy. In catalytic water splitting, the hydrogen evolution reaction (HER) takes place at cathode, and the oxygen evolution reaction (OER) occurs at anode. The catalysts are the role to reduce the activation energies (E_a) of electrode reactions, and improve their reaction kinetics during water splitting. Compared with HER, OER is the one with much more sluggish reaction kinetics. To improve the efficiency in overall water splitting, making suitable catalysts for optimizing the kinetics of OER is the great challenge. The principle in fabrication of catalyst materials usually corresponds with “cost-efficient” which means high activity yet low cost. In this work, the transition-metal complexes containing Schiff-base ligand, tmeda-hi, was synthesized to construct a novel kind of 3D Ni²⁺ metallic-organic frameworks. (MOFs). In our preliminary results, the MOF catalysts were proved to exhibit high activity in OER with a low overpotential of 390 mV (at 10 mA/cm²) in 1 M NaOH. Meanwhile, the results of *in-operando* XRD illustrate that this kind of MOF structure has durable stability in such alkaline solution. By *in-operando* XAS measurements, the electronic state of Ni²⁺ in the MOF structure was not significantly changed while chronoamperometric test (i-t curve). It illustrates for the low portion of the MOFs contributing to the OER. In future work, we are urged by the results to optimize the portion of Ni²⁺ that participate in OER, and will look into the corresponding Tafel Plot, electrochemical impedance spectroscopy (EIS), and turnover frequency (TOF). Overall, the 3D Ni-MOFs is a kind of new catalyst low in cost, that allows possible insights into the reaction mechanism in OER.

KEYWORDS: oxygen evolution, metal-organic framework, nickel