Hierarchically porous nano architecture constructed by ultrathin $CoSe_2$ embedded Fe-CoO nano sheets as robust electro catalyst for water oxidation

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Abstract

The sluggish kinetics and high cost of the noble-metal based electro catalyst for oxygen evolution reaction (OER) still seriously limits the efficiencies of water splitting. Herein, for the first time, we rationally design a porous hierarchical nano architecture, constructed by ultrathin $CoSe_2$ embedded Fe-CoO nano sheets ($CoSe_2$@Fe-CoO), which is synthesized via self-assembly hydrolysis driven *in-situ* synergetic salinization of Fe/Co/O/Se precursor followed by Ostwald ripening. As an OER catalyst, the porous $CoSe_2$@Fe-CoO hybrid with abundant CoOOH electro active sites delivers a small Tafel of 56.2 mV/dec with very low onset over potential of 280 mV@10 mA/cm^2 and excellent long-term physicochemical stability till 62 h without obvious decay, which outperforms well-established benchmark electro catalysts (RuO_2). The boosted OER performance of $CoSe_2$@Fe-CoO nano sheets is mainly attributed to its iron-doping effect, porous nano architecture, and multicomponent synergetic/interfacial effect between ultrathin cobalt (II) oxide and conductive cobalt selenide ($CoSe_2$) nano framework. This work presents a facile construction strategy to find a nonprecious hybrid OER electro catalyst with excellent performance and long-term stability.