Three-dimensional porous nano architecture constructed by ultrathin $NiCoBO_x$ nano sheets as a highly efficient and durable electro catalyst for oxygen evolution reaction

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Abstract

It is still challenging to develop highly efficient catalysts for oxygen evolution reaction due to their sluggish kinetics for water splitting. To address such issue, herein, for the first time, self-assembled three-dimensional porous nano architecture, constructed by ultrathin cobalt-nickel-boron oxide ($NiCoBO_x$) nanosheets, is synthesized by a facile boro hydride/amine hydrolysis strategy. As an oxygen evolution electrocatalyst, the $NiCoBO_x$ nano architecture delivers excellent performance with a very low overpotential of 290 mV to achieve 10 mA cm−2 and a small Tafel slope of 59.2 mV dec−1 in an alkaline medium, which is analogous to the performance of RuO_2. Moreover, it shows outstanding physiochemical long-term stability with excellent current density retention even after 70 h. Its OER performance is reassessed to the benchmark catalyst and practically very virtuous within most reported Ni/Co-based OER electro catalysts. The rationally designed 3D porous nano architecture of borate anchored ultrathin $NiCoO_x$ nanosheets (NiCoB)-O_x favours the transportation of electrons and diffusion of ions during catalysis process, thus significantly enhancing its catalytic activity. This work provides a facile and low-cost synthesis strategy to fabricate 3D porous electrocatalyst with rational nano architecture for highly efficient and stable OER.