Tunable NiFe-LDH Electrocatalyst Synthesis via Benzyl Alcohol Solvation for Enhanced Water-splitting

Al-Ghamdi, Abdullah (School: Alhussan Private School)

Transition metal-based layered double hydroxide (LDH) water-splitting electrocatalysts are known to have distinctive structural and electronic properties that facilitate the water-splitting process. However, their poor conductivity and ease of agglomeration limit their practical application. In this work, the growth of ultrathin layers of nickel-iron layered double hydroxide (NiFe-LDH) electrocatalyst in the presence of benzyl alcohol as a solvent is studied. The preparation method is simple and provides a versatile reaction system where particle size, crystallinity, and morphology could be tuned to enhance the material's performance further. The electrocatalyst is characterized by standard techniques, such as X-ray Photoelectron Spectroscopy (XPS), X-Ray Diffractometry (XRD), and electron microscopy (FESEM, TEM, HR-TEM). The catalytic ability of the prepared NiFe-LDH is evaluated by monitoring the oxygen evolution reaction (OER) in a 1.0 M KOH aqueous electrolyte. The electrode exhibits remarkable performance for the OER – the current density of 10 mA cm-2 is obtained at an overpotential of only 270 mV. The electrode shows excellent electrochemical stability, low intrinsic resistance, and high surface area under the applied parameters. The comparable electrochemical performance of NiFe-LDH could be attributed to the interaction between the metal and benzyl alcohol, which leads to the reduction of layers stacking and the formation of thin layers of LDH. The nanostructured electrode material synthesized via the simple benzyl alcohol route is promising in the application of oxygen evolution and can be implemented in large-scale projects to contribute to the renewable energy sector.

Awards Won: