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SUPERHYDROPHILIC, SUPERAEROPHOBIC NIFE-LDH@NI95CU5 ELECTRODE FOR EFFICIENT OER CATALYSIS

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Abstract

Water splitting is a promising technique to produce green hydrogen, but it is severely limited by the sluggish kinetics of the oxygen evolution reaction (OER). Addressing this issue demands not only efficient OER catalysts but also better electrode structure which can guarantee effective and stable utilization of the catalysts. Superhydrophilic/superaerophobic porous structure is an ideal candidate for gas evolution reactions. However, fabricating such electrodes usually involves complex procedures and harsh conditions. Moreover, the effects of porous structure on electrode hydrophilicity, aerophobicity, and thereby the OER kinetics have not yet been systematically investigated. Herein, using NiFe-LDH as a presentative OER catalyst,

we developed a facile two-step electrodeposition method to prepare superhydrophilic/superaerophobic NiFe-LDH@$Ni_{100-x}Cu_x$ electrodes at room temperature. The porous electrode structure was tuned by varying Cu content in the $Ni_{100-x}Cu_x$ scaffolds. As a result, the NiFe-LDH@$Ni_{95}Cu_5$ electrode with a hierarchical porous structure displayed both superhydrophilicity and superaerophobicity. Consequently, a small OER overpotential of 286 mV at 300 mA·cm^{-2} was achieved on the NiFe-LDH@$Ni_{95}Cu_5$, which was 74 mV lower than that on the NiFe-LDH@NF (commercial Ni foam). The NiFe-LDH@$Ni_{95}Cu_5$ also displayed high stability even it was subjected to 100 hours of durability test at 300 mA·cm^{-2}, 60 °C in 30 wt.% KOH. The outstanding OER catalytic performance of the NiFe-LDH@$Ni_{95}Cu_5$ electrode and its convenient fabrication technique provide a new strategy for future design and preparation of novel electrodes for efficient gas revolution reactions.

Keywords:

Porous; Superhydrophilicity; Superaerophobicity; Nife-LDH, Oxygen Evolution Reaction