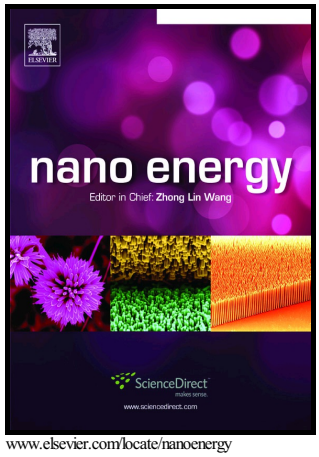

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PII: S2211-2855(17)30147-7
DOI: http://dx.doi.org/10.1016/j.nanoen.2017.03.016
Reference: NANOEN1844

To appear in: *Nano Energy*

Received date: 9 December 2016
Revised date: 1 March 2017
Accepted date: 6 March 2017

Cite this article as: Huawei Huang, Chang Yu, Changtai Zhao, Xiaotong Han Juan Yang, Zhibin Liu, Shaofeng Li, Mengdi Zhang and Jieshan Qiu, Iron-tunec Super Nickel Phosphide Microstructures with High Activity for Electrochemica Overall Water Splitting, *Nano Energy* http://dx.doi.org/10.1016/j.nanoen.2017.03.016

Iron-tuned Super Nickel Phosphide Microstructures with High Activity for Electrochemical Overall Water Splitting

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Abstract

Large-scale hydrogen production by electrolytic splitting of water is mainly governed by high-efficient yet cheap electrocatalysts that could be capable of accelerating the sluggish hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). Herein, we report Fe-tuned Ni_2P electrocatalysts with controllable morphology and structure by regulating atomic ratio of Ni/Fe, and reveal the Fe species-modulated electronic state behaviors and -boosted catalytic activity for water splitting. The electrocatalytic activity of Fe-tuned Ni_2P nanosheets for both HER and OER can be further enhanced by assembling the nanosheets vertically on conductive 2D carbon fiber (CF) matrix to make hierarchical monolithic 3D electrode ($Ni_{1.5}Fe_{0.5}P$/CF), which features more accessible active sites and open structure that helps to speed up both the HER and OER. The improved electrocatalytic activity of $Ni_{1.5}Fe_{0.5}P$/CF is due to the combined synergistic effects of the high conductivity of CF matrix and the strong interaction between active species and the CF support, as evidenced by a low overpotential of 293 mV to achieve a high current density of 100 mA cm^{-2} with superiorly long-term stability for OER. When the monolithic 3D $Ni_{1.5}Fe_{0.5}P$/CF electrodes were used as both anode and cathode for overall water splitting, a current density of 10 mA cm^{-2} is

[1] The first two authors contributed equally to this work