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PII: S0167-577X(18)31054-1
DOI: https://doi.org/10.1016/j.matlet.2018.07.023
Reference: MLBLUE 24589

To appear in: *Materials Letters*

Received Date: 22 May 2018
Revised Date: 30 June 2018
Accepted Date: 5 July 2018

Please cite this article as: W-K. Gao, J-H. Lin, K. Wang, Z-Z. Liu, J-F. Qin, J-Y. Xie, X-Y. Zhang, Y-M. Chai, B. Dong, Controllable phosphorsulfurization of uniform binary Ni-Fe nanocubes for enhanced water oxidation, *Materials Letters* (2018), doi: https://doi.org/10.1016/j.matlet.2018.07.023

Controllable phosphorsulfurization of uniform binary Ni-Fe nanocubes for enhanced water oxidation

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Abstract

Developing bimetallic electrocatalysts with unique nanostucture for oxygen evolution reaction (OER) is crucial for promoting water splitting. Herein, Ni-Fe nanocubes (NiFe NCs) have been synthesized as the templates through a self-assembly process. Then phosphorization, sulfurization or coupling process has been used to prepare different binary Ni-Fe nanocubes samples. The coupled phosphorization and sulfurization (P-S-NiFe NCs) can improve the intrinsic activity, which may be due to rough surface with rich active sites towards OER. Moreover, compared to S-NiFe, P-NiFe and S-P-NiFe NCs, P-S-NiFe NCs maintains intact cubic structure and exhibits superior OER performance with an overpotential of 270 mV to drive a current density of 10 mA cm^{-2}. The order of phosphorization and sulfurization are the key for unique structure and excellent activity. Therefore, the controllable phosphorsulfurization treatment of binary metal-based nanostructure may be a promising strategy to prepare excellent electrocatalysts for water oxidation.

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