

Monolithic Cobalt Phosphide Nanowire Electrodes for Efficient and Durable Water Splitting

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Abstract

Hydrogen (H₂) is a promising energy carrier and has many advantages over hydrocarbons for use as a fuel for both stationary power and transportation. Water electrolysis has been proposed to be the cleanest way to produce H₂, because unlike steam reforming of hydrocarbons this process doesn't emit any pollutants and water is an inexpensive renewable resource. More importantly, H₂ produced from water electrolysis has high purity and is free of carbon monoxide, and therefore can be directly used to feed fuel cells without a risk of poisoning the anode catalysts.

Water electrolysis usually cannot be efficiently accomplished without a catalyst. Recently, metal phosphides have emerged as a new class of electrocatalysts that can promote both the H₂ evolution reaction (HER) and oxygen (O₂) evolution reaction (OER) [1-3]. In this presentation, a monolithic cobalt phosphide (Co-P) nanowire electrode will be presented, which were prepared by a simple one-step vapor-solid reaction method [4]. The obtained Co-P nanowire electrodes exhibits excellent electrocatalytic performance for both HER and OER as well as overall water splitting. Significantly, the electrode can sustain upon long-term water electrolysis for up to 1000 h without degradation, showing extraordinary operational stability.

References

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- [4] W. Li, X. Gao, D. Xiong, F. Xia, J. Liu, W. Song, J. Xu, S. Thalluri, M. F. Cerqueira, X. Fu, L.F.Liu, *Chem. Sci.* 2017, DOI: 10.1039/C6SC05167G

Figures

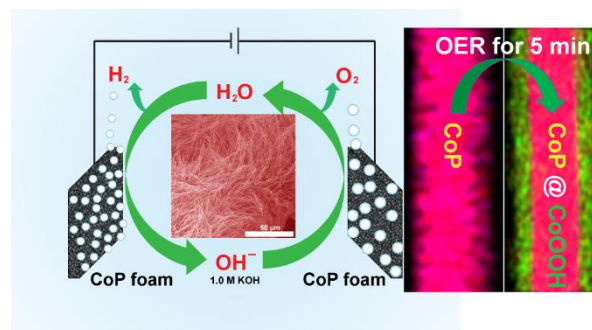


Figure 1. (left) A scheme showing overall water splitting using two symmetrical monolithic Co-P nanowire electrodes as anode and cathode. (right) STEM elemental maps of a single Co-P nanowires showing the conversion of phosphide to oxyhydroxide upon the OER.

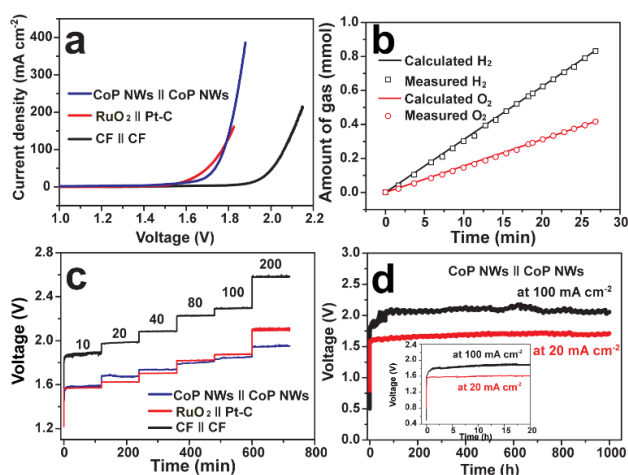


Figure 2. Overall water splitting performance of the two-electrode Co-P NW electrolyzers.