Accepted Manuscript

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PII: S0013-4686(18)30005-7

DOI: 10.1016/j.electacta.2018.01.005

Reference: EA 30987

To appear in: *Electrochimica Acta*

Received Date: 9 September 2017

Revised Date: 6 December 2017

Accepted Date: 2 January 2018

Please cite this article as: L. Zou, Y. Jiang, J. Cheng, Y. Chen, B. Chi, J. Pu, L. Jian, Bifunctional catalyst of well-dispersed RuO_2 on $NiCo_2O_4$ nanosheets as enhanced cathode for lithium-oxygen batteries, *Electrochimica Acta* (2018), doi: 10.1016/j.electacta.2018.01.005.

Bifunctional Catalyst of Well-dispersed RuO_2 on $NiCo_2O_4$ Nanosheets as Enhanced Cathode for Lithium-Oxygen Batteries

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Abstract: The electrochemical properties of Li–O_2 batteries are mainly restricted by the kinetics of the OER (oxygen evolution reaction) before realizing high-rate and long-term cycling performance. Among various excellent OER catalysts, RuO_2 has shown excellent catalytic activity and good electrical conductivity. Here, a bifunctional catalyst with RuO_2 well dispersed on $NiCo_2O_4$ nanosheets has been studied, showing a low OER Tafel slope of as low as 58 mV/decade in alkaline media. While assembled in Li–O_2 batteries with RuO_2@$NiCo_2O_4$ cathode, a large specific discharge capacity as high as 17633 mAh g^{-1} can be obtained at a current density of 200 mA g^{-1} with a coulombic efficiency of 91%. A long-term stability about 128 cycles can be achieved without much deterioration. The excellent electrochemical performance is strongly correlated with the nanosheets like structure for easy O_2 diffusion, electrolyte permeation, sufficient space provision of Li_2O_2 deposition and cooperation of $NiCo_2O_4$ and RuO_2, which exhibits excellent ORR (oxygen reduction reaction) and OER catalytic activity respectively.

Keywords

Lithium-oxygen batteries, ruthenium oxide nanoparticles, nickel cobalt oxide nanosheets, oxygen evolution reaction, Li_2O_2 film

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