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# Honeycomb-like Ni<sub>3</sub>S<sub>2</sub> Supported on Ni Foam as High Performance Free-standing Cathode for Lithium Oxygen Batteries

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## Abstract

Herein, we report the design and synthesis of a unique honeycomb-like Ni<sub>3</sub>S<sub>2</sub> structure growing directly on the Ni foam skeleton (H-Ni<sub>3</sub>S<sub>2</sub>/NF) and its application in lithium-oxygen (Li-O<sub>2</sub>) batteries as a free-standing cathode. Excellent electrocatalytic activity of honeycomb-like Ni<sub>3</sub>S<sub>2</sub> and the unique network structure of Ni matrix can provide synergistic effect for facilitating electron transport and the diffusion of both oxygen and Li<sup>+</sup>, leading to the excellent electrochemical performance of Li-O<sub>2</sub> battery. Specifically, Li-O<sub>2</sub> batteries with H-Ni<sub>3</sub>S<sub>2</sub>/NF electrodes exhibit high energy efficiency (84.2%), outstanding cycle stability of over 116 cycles at limiting capacity of 4 mA h cm<sup>-2</sup> and excellent rate capability (9.84 mAh cm<sup>-2</sup> at 12 mA cm<sup>-2</sup>).

Keywords: Free-standing; Cathode; Honeycomb-like Ni<sub>3</sub>S<sub>2</sub>; Lithium-oxygen batteries.

## 1. Introduction

The lithium-ion battery (LIB) based on intercalation mechanism has made a great progress in recent decades. However, the real energy density of state-of-the-art LIB is much lower than the theoretical value, and it can't meet with the urgent

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