CoSe₂ Nanoparticles as Anode for Lithium Ion Battery

Wanzheng Lu, Mingzhe Xue*, Xiaolan Chen and Chen Chen

Clean Energy Automotive Engineering Center, School of Automotive Studies, Tongji University, Shanghai 201804, China

*E-mail: heroxmz@hotmail.com, mzxue@tongji.edu.cn

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Orthorhombic CoSe₂ nanoparticles were synthesized via a facile one-step hydrothermal approach. The size, morphology, as well as phase structure were characterized by scanning electron microscopy (SEM) and powder X-ray diffraction (XRD). It was confirmed that CoSe₂/Li battery cycled between 2.5 V and 0 V was more appropriate than between 3.0 V and 0 V. And the initial discharge capacity was 975.9 mAh g⁻¹ at a current density of 100 mA g⁻¹, while it increased after about 90 cycles, and even exceeded theoretical discharge capacity (494.4 mAh g⁻¹) after about 485 cycles due to the activating reactions and the electric double layer effect. Electrochemical mechanism of CoSe₂ as anode for lithium ion battery was verified by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). It showed that solid electrolyte interface (SEI) started to be formed at 1.4 V in the first discharge process. SEI-film resistance (R_{SEI}), electron-transfer resistance (R_e), and charge-transfer resistance (R_{ct}) played the key part in the first discharge process of lithium intercalation respectively.

Keywords: CoSe₂ nanoparticles; Anode; Lithium ion battery; Electrochemical mechanism; Solid electrolyte interface

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