Sodium-Selenium Batteries with Outstanding Rate Capability by Cubic Mn2O3 Electro catalyst

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June 21, 2023

Abstract

With their high volumetric capacity and electronic conductivity, sodium-selenium (Na-Se) batteries have attracted attention for advanced battery systems. However, the irreversible deposition of sodium selenide (Na2Se) results in rapid capacity degradation and poor Coulombic efficiency. To address these issues, cubic α-Mn2O3 is introduced herein as an electrocatalyst to effectively catalyze Na2Se conversion and improve the utilization of active materials. The results show that the addition of 10 wt% Mn2O3 in the Se/KB composite enhances the conversion from Na2Se to Se by lowering activation energy barrier and leads to fast sodium-ion kinetics and low internal resistance. Consequently, the Mn2O3-based composite delivers a high specific capacity of 635 mAh·g⁻¹ at 675 mA·g⁻¹ after 250 cycles as well as excellent cycling stability for 800 cycles with a high specific capacity of 317 mAh·g⁻¹ even at the high current density of 3375 mA·g⁻¹. Due to the cubic Mn2O3 electrocatalyst, the performance of the composites is mostly superior to existing state-of-the-art Na-Se batteries reported in the literature.

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