Preparation of $\text{Cu}_2\text{S}@ \text{Li}_4\text{Ti}_5\text{O}_{12}$ Composite Electrode with Excellent Lithium Storage Performance by Spray Drying Reaction

Yingjie Zhang, Qian Feng, Xue Li*

National and Local Joint Engineering Laboratory for Lithium-ion Batteries and Materials Preparation Technology, Faculty of Metallurgical and Energy Engineering, Kunming University of Science and Technology, Kunming 650093, PR China

*E-mail: 438616074@qq.com

doi: 10.20964/2020.10.01

Received: 26 May 2020 / Accepted: 21 July 2020 / Published: 31 August 2020

In this work, spherical lithium titanate was prepared by spray drying. Then, copper particles were deposited on the lithium titanate using a copper mirror reaction. Finally, the composite was vulcanized to produce $\text{Cu}_2\text{S}@ \text{Li}_4\text{Ti}_5\text{O}_{12}$ materials (named $\text{Cu}_2\text{S}@ \text{LTO}$). As a coating layer capable of lithium storage, Cu_2S can effectively improve the conductivity and lithium storage capacity of lithium titanate materials. Improving the low conductivity of lithium titanate increases its specific capacity. Morphological and structural analyses show that the prepared composite material has a spherical structure and that Cu_2S is uniformly dispersed on the surface of the spherical particles with a high degree of crystallinity. In addition, the electrochemical performance of the lithium-ion battery cathode material $\text{Cu}_2\text{S}@ \text{LTO}$ in an ether electrolyte and ester electrolyte (LB303) was studied. The results show that the $\text{Cu}_2\text{S}@ \text{LTO}$ anode material has a better electrochemical performance in the ether electrolyte than that in the ester electrolyte. The first specific capacity reaches 206 mA h/g. The capacity retention rate is 91% after 30 cycles. Even at a high rate, the capacity retention rate after 100 cycles can still be maintained at 98.5%. The excellent electrochemical energy source is due to the synergistic effect of Cu_2S and lithium titanate, which not only improves the conductivity and specific capacity of lithium titanate but also effectively relieves the volume expansion of Cu_2S during lithium storage, thereby extending the battery cycle life.

Keywords: Lithium titanate modification; spray drying; copper mirror reaction; lithium-ion battery

[FULL TEXT](#)

© 2020 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).