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Lithium-Ion Batteries Anodic Performance of Porous Sn/C-ZnO Core-Shell Structures Derived from ZIF-8

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Zeolitic imidazolate frameworks are a class of metal organic frameworks which are very attractive for their pore structures. However, their pore size and the BET surface would shrink when they underwent heat treatment at high temperature. On the other hand, liquid metal in MOFs might flow through the pores and prevent the shrinkage when pyrolysis. As is known that metallic Sn is liquid when the temperature is above 232 °C, flowing Sn might support and maintain the porous structure of MOFs during the pyrolysis. In this work, porous Sn/C-ZnO core-shell structures were prepared as anodes for LIBs via a two-step method. Firstly, SnO_2 particles were encapsulated in a ZIF-8 layer with different thickness. Then Sn/C-ZnO was generated in inert atmosphere at 700 °C. A Sn/C-ZnO composite, with 11.2% of Sn and 21.0% of ZnO in content, had a BET surface of 32.9 m^2 g^{-1}. Another Sn/C-ZnO composite, with 55.1% of Sn and 1.8% of ZnO in content, had a larger BET surface of 297 m^2 g^{-1}. Then the two composites were tested as anodes for LIBs. Although the BET surface of the former was significantly less than that of the latter before cycling and the content of Sn in the former was also much lower than that of the latter, the discharge capacity of the former after 50 cycles was 515.6 mAh g^{-1} at 100 mA g^{-1} in the potential of 0.01~3.00 V, which was slightly higher than that of the latter.

Keywords: Lithium-ion batteries; anode; MOFs; metallic Sn; core-shell structure

FULL TEXT