Influence of Ag/C coating modification on electric performance of solid solution Li[Li_{0.2}Mn_{0.54}Ni_{0.13}Co_{0.13}]O_2

Qingrui Xue, Guoyao Pang, Jianling Li
State Key Laboratory of Advanced Metallurgy, University of Science and Technology Beijing, No.30 College Road, Beijing 100083, China.
Correspond to lijianling@ustb.edu.cn

Compared with conventional cathode materials for lithium ion batteries, solid solution Li[Li_{0.2}Mn_{0.54}Ni_{0.13}Co_{0.13}]O_2 has many merits, such as higher capacity, lower toxicity, lower cost, and so on. In this paper, the cathode material Li[Li_{0.2}Mn_{0.54}Ni_{0.13}Co_{0.13}]O_2 with high capacity was successfully synthesized, using sulfates as the transition metal sources by the co-precipitation method. Coating modification with Ag and Ag/C were conducted to improve the reversible capacity and rate capability. Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were also used to investigate the electrochemical mechanism.

The results showed that Ag/C coating on the surface of Li[Li_{0.2}Mn_{0.54}Ni_{0.13}Co_{0.13}]O_2 material can improve the coulombic efficiency and rate capability. While the Ag/C coating materials showed better electrochemical performance, the first specific discharge capability increased to 273 mAh/g at 0.05C (as shown in Fig.1) and 219 mAh/g at 1C (in Fig.2).

EIS results showed that Ag and Ag/C coating layers could resist the corrosion of cathode materials in electrolyte and could stabilize the interface layer, resulting in reduced interface impedance and improved electrochemical performance. CV test showed that Ag could inhibit oxygen ejection from Li[Li_{0.2}Mn_{0.54}Co_{0.13}Ni_{0.13}]O_2 which effectively reduced irreversible capacity loss at the initial cycle, thus improving the material discharge capacity.

Fig.1 First specific discharge capability of the sample coated by Ag/C at 0.05C

Fig.2 Discharge curves of the sample coated by Ag/C at different rates

Acknowledgements
This work was financially supported by the National Natural Foundation of China (NO.51172023), 863 Program (NO.2012AA110302), the National Natural Foundation of China (No. 51372021)