Graphene-Armored Aluminum Foil as Current Collectors for High-voltage Lithium-Ion Battery

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Abstract

Lithium-ion batteries (LIB) have become one of the most promising power sources to meet the ever increasing demand for high-performance electric devices. Recently, the issue of corrosion happened on aluminum (Al) foil began to receive attention. In order to improve the potential of cathode to improve the energy density of LIB, it's crucial to solve the problem of the corrosion of Al foil. Here, we directly grow graphene film on commercial Al foil for current collectors via plasma-enhanced chemical vapor deposition (PECVD) method and take it as electrically conductive coating layers and interfacial barrier layers to enhance the anticorrosion performances of Al foil at high voltage in LIB. It is demonstrated that Al foil armored by such graphene film shows significantly reinforced anodic corrosion resistance and $LiNi_{0.5}Mn_{1.5}O_4$ cells using graphene-armored Al foil (GAl) as current collectors show enhanced cycling performance compared to the cells with pristine Al foil. Moreover, the rate performance is also improved due to the graphene nanosheet grown by PECVD improving the adhesion between active materials and current collectors. This work not only contributes to the long-term stable operations of LIBs but also provides feasibility for next-generation high-voltage lithium ion batteries.

References

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[2] T. Ma, G. L. Xu, Y. Li, L. Wang, X. He, J. Zheng, J. Liu, M. H. Engelhard, P. Zapol, L. A. Curtiss, J. Jorne, K. Amine and Z. Chen, J. Phys. Chem. Lett., 8 (2017) 1072.

Figures

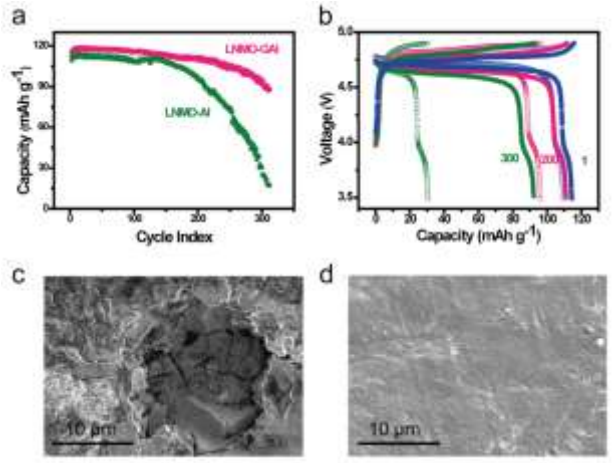

Figure 1: Enhanced anticorrosion performance of GAl. (a,b) Long-term cycling performance of LNMO/GAl and LNMO/Al cells; (c, d) SEM images of pristine Al foil and GAl after cycling;

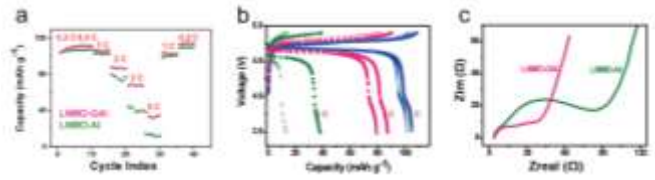

Figure 2: Enhanced electrochemical performance of GAl. (a,b) Rate performances of LNMO/GAl and LNMO/Al cells; (c) EIS analysis of LNMO/GAl and LNMO/Al cells