High performance and rate capability of Li$_3$V$_2$(PO$_4$)$_3$/Ag+-graphene cathode materials for Li-ion batteries

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The Li-ion batteries (LIBs) have been regarded as one of the promising sources to satisfy the growing demand of energy storage system, because the LIBs have numerous advantages of the high capacity, high operating voltage and long cycle life [1-3]. Recently, the monoclinic Li$_3$V$_2$(PO$_4$)$_3$ (LVP) has been considered as a cathode material for the advanced LIBs due to high lithium-ion mobility, reversible capacity, operating voltage and safety. However, the intrinsic low electronic conductivity of the LVP at room temperature, which is major drawback for the application of the LIBs, limits its rate capability. In order to improve the low electronic conductivity, many efforts such as minimizing the particle size, doping with metal or surface coating with conducting materials has been conducted.

In this study, we have synthesized the LVP/Ag+graphene cathode materials by a solution-based method.

![Figure 1. SEM image of the (a) pristine LVP, (b) LVP/G, (c) LVP/Ag and (d) LVP/Ag+graphene.](image1)

The structure and morphology of the samples were characterized by an X-ray diffraction (XRD), a Raman and scanning electron microscopy (SEM). The LVP/Ag+graphene composites showed the decreased particles, large surface area, which led to enhanced electronic conductivity, improved rate capabilities and cycling stability.

![Figure 2. first charge-discharge curves of the (a) pristine LVP, (b) LVP/G, (c) LVP/Ag and (d) LVP/Ag+graphene.](image2)

In electrochemical performance, the composites showed the initial discharge capacity of 135 and 188 mAh g\textsuperscript{-1} at 0.1 C in the potential range of 3.0-4.3 and 3.0-4.8V, respectively. Even at a high C-rate of 10 C, it delivered the discharge capacity of 118 and 138 mAh g\textsuperscript{-1}, respectively. Electrochemical impedance spectroscopy (EIS) measurement showed that the composites had the low charge transfer resistance resulting in improved electronic conductivity.

The details of results will be discussed in the meeting.

References:

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