Electrochemical Study of Poly(*N*-vinylformamide) as a Binder for $LiFePO_4$ in Li-Ion Batteries

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In this study, a water-soluble polymer, poly(*N*-vinylformamide) (PNVF), has been used as a binder for $LiFePO_4$ and conductive carbon in the cathode of LIB. The surface morphology of cathodes has been analyzed by SEM. The coin cell composed with PNVF as the binder (PNVF-cell) shows excellent cell performance and long-term stability. The cell specific capacities of PNVF-cell are 138, 110, and 100 $mAhg^{-1}$ at 1C, 3C, and 5C discharge rate. (Figure 1) After 300 cycle charge-discharge cycles at 1C to 5 C-rate, there are still capacitance value of 100 $mAhg^{-1}$, and the columbic efficiency values was close to 100%, which means that a very low level of capacitance values recession. It is especially worth to note that the cell voltage can be maintained at 3.2 V even at 5 C-rate. The results of EIS analysis also indictates that charge transfer resistance (R_{ct}) for the PNVF-cell is 6.1 Ω after activation, which is much lower than that in a PVDF-cell (83 Ω). (Figure 2) The CV analysis. In addtion, the CV analysis shows that the difference between the redox peaks is 0.166 V for PNVF-cell, which is much smaller that for PVDF-cell (0.315 V). In terms of above electrochemical studies, we have concluded that PVNF could significantly reduce the resistance of lithium intercalation–deintercalation on the surface of $LiFePO_4$ particles.

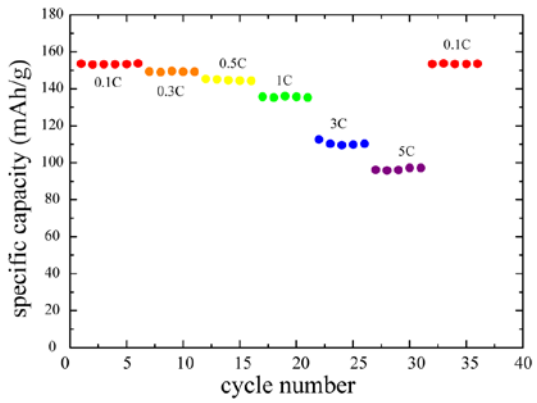

Figure 1. Rate performance of the PNVF-cell

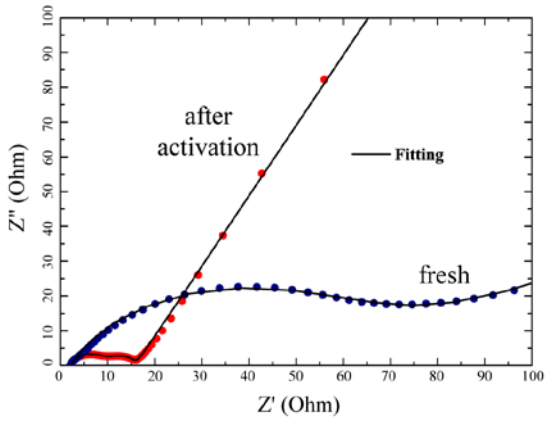

Figure 2. Nyquist plots of the PNVF-cell