

## Surface Modified Graphite for Li-ion Battery

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In recent years, research on the graphite anode for lithium ion batteries has been focused on the development of graphite electrode, which can be cycled in propylene carbonate (PC) based electrolyte. The use of PC based electrolyte in the Li-ion battery would improve the rate performance and also improve the safety of the battery. But, the addition of PC to the electrolyte leads to exfoliation of the graphite. Therefore, it is necessary to modify the graphite to be cycle in the PC based electrolyte without exfoliation. The surface modifications of graphite have been done by coating carbon and metal on the graphite particle [1,2]. Such modifications were found to reduce the exfoliations. We have reported the improvement in coulombic efficiency for the CVD carbon coated graphite and hard carbon [1]. In this report we will discuss about the use of this modified graphite electrode in the PC based electrolyte.

The synthetic graphite powder was coated by carbon from the CVD process carried out at different temperatures with source gas of ethylene. Electrochemical measurements were made in a three-electrode half-cell system. The working electrode was made by mixing graphite with 8% polyvinylidene difluoride (PVDF) in N-methyl pyrrolidinone. The electrolyte was 1M LiClO<sub>4</sub> in EC/DEC(1:1) and in EC/DEC/PC (1:2:1) with lithium foils as counter and reference electrodes

The charge/discharge curve of the pristine graphite electrodes in EC/DEC/PC electrolyte is shown in fig.1. The pristine electrode is exfoliated and gives a reversible capacity of around 316Ah/kg and the coulombic efficiency of only 21%.

Figure 2 shows the charge/discharge curve of the CVD processed graphite electrodes in EC/DEC/PC electrolyte. The CVD processed electrode is not exfoliated and gives the reversible capacity of 370Ah/kg and the coulombic efficiency of 81%.

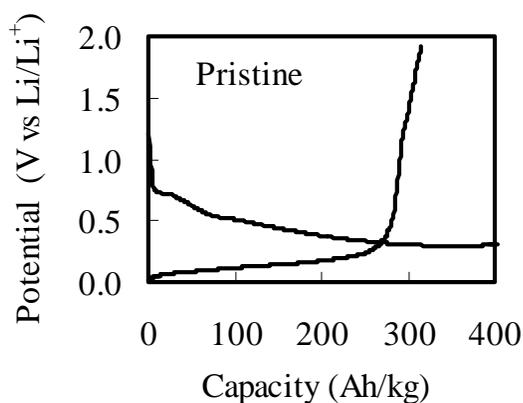


Fig.1 The charge/discharge curves of the pristine graphite electrodes in EC/DEC/PC

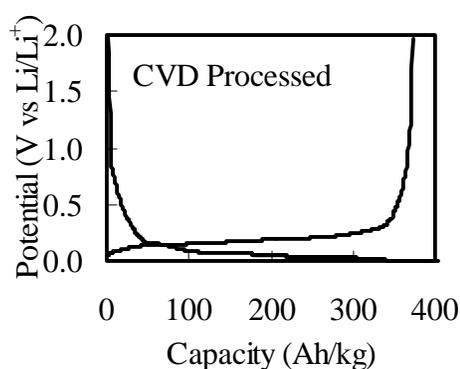


Fig.2 The charge/discharge curves of the CVD processed graphite electrodes in EC/DEC/PC.

The electrochemical improvements of the CVD processed electrodes are discussed based on the Li-NMR and DSC analysis.

### Acknowledgment:

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### Reference:

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