The properties of sub-micrometer layered LiNi0.5Mn0.5O2

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Recently, extensive attention has been devoted to layered LiNi0.5Mn0.5O2 due to its high capacity, cycling stability, low cost, and thermal safety [1-3]. In this paper, the properties of layered LiNi0.5Mn0.5O2 prepared by solid reaction method are introduced.

EXPERIMENTAL

LiNi0.5Mn0.5O2 samples were prepared by solid reaction method, in which stoichiometric amount of nickel nitrate, manganese nitrate and LiOHH2O were used as the original materials. The dried alkaline precursor was subjected to further heat treatment at different temperatures in oxygen atmosphere. The thermal behavior of the dried precursor was examined by use of DTA, TGA, and XRD measurements.

The electrochemical performance of the samples was studied by voltammetry in a three-electrode cell. The charge-discharge capacities of samples were measured in R2025 type button cells at current density of 2mAcm-2. The cut- off voltages were 4.3V and 2.5V for charge and discharge processes respectively. The working electrode was composed of 80% LiNi0.5Mn0.5O2, 15% acetylene black, and 5% PTFE binder. The electrolyte was 1M LiPF6 in EC:DMC = 1:1 solution.

RESULTS AND DISCUSSION

The XRD patterns of LiNi0.5Mn0.5O2 treated at different temperature indicated that the sample synthesized at 7500C presents the layered hexagonal structure with a, c values of 2.87 and 14.23 respectively. Sub-micrometer sized particles can be obtained for the sample synthesized at 7500C for 24h as shown in Fig.1.

The TGA and DTA results indicated that during the calcination process there were three major weight losses and endothermic peaks in the temperature ranges of 75-100°C, 150-250°C, and 400-500°C respectively. It may correspond the loss of adsorbed water and the formation of LiNi0.5Mn0.5O2. Although LiNi0.5Mn0.5O2 can be formed at 450C, but the complete reaction may occur at 7500C.

Fig.2 presents the voltammogram of LiNi0.5Mn0.5O2. A couple of redox current peaks at 3.9V and 3.72V are observed. The chargedischarge curves in Fig.3 show that there is one discharge voltage plateau, and no obvious change for the discharge curves during initial three cycles. The initial discharge capacity for LiNi0.5Mn0.5O2 sample synthesized at 7500C was 152mAhg-1 and it decreased to 139mAhg-1 after 40 cycles. The sample treated at 7500C performed better stability than that formed in lower temperature as shown in Fig.4. The results of impedance measurement will be discussed.

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Fig.1 SEM imagine of LiNi0.5Mn0.5O2 powder.

Fig.2. Voltammogram of LiNi0.5Mn0.5O2 electrode, scan rate: 0.1mV/s.

Fig.3 Charge-discharge curves for Li/LiNi0.5Mn0.5O2 cell

Fig. 4. Cycling stability of samples synthesized at different temperature for 24hrs.