Study spherical and flake type graphite as negative electrode materials for power type lithium ion battery

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Power type 18650 lithium ion battery which was 550 mAh capacity have been studied by using $LiMn_2O_4$ as a cathode material and spherical type graphite (MCMB-1028) as well as flake type graphite (O-PCG) as anode materials. Discharge characteristic shown that the discharge capacity ratio of 3C rate (1.65A) to 0.2C rate (0.11A) are large than 90% for both $LiMn_2O_4$/MCMB and $LiMn_2O_4$/PCG lithium ion batteries respectively (Fig. 1). However, the cycling performance of $LiMn_2O_4$/MCMB and $LiMn_2O_4$/PCG were quite different at 1C charge-discharge rate at room temperature. The cycle life characteristic was also investigated in this study. The results shown $LiMn_2O_4$/MCMB had 87% capacity retention after 300 cycling, but $LiMn_2O_4$/PCG only had 27% capacity retention after 50 cycling (Fig. 2). In order to understand the capacity fading mechanism, SEM-EDS and XPS analysis were used to characterize the surface of graphite. From the SEM-EDS analysis, there was no Mn signal appeal on the PCG surface after 50 cycles. Therefore, the dissolution of Mn from $LiMn_2O_4$ and then deposited on PCG was not the major capacity fading mechanism for $LiMn_2O_4$/PCG battery during cycles. It was found PCG had more thick SEI film than MCMB after cycling by XPS surface analysis. It was recommend that the capacity fading during cycle testing may due to the decomposition of electrolyte to form the different thickness property of SEI film on the PCG and MCMB surface..

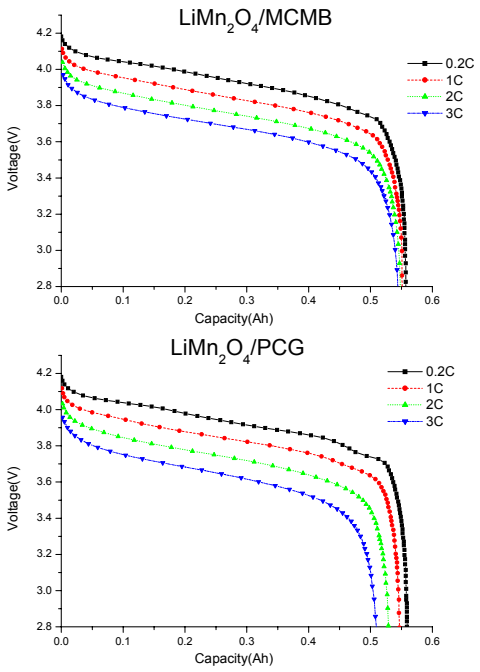

Fig. 1 Discharge characteristic of $LiMn_2O_4$/MCMB and $LiMn_2O_4$/PCG batteries.

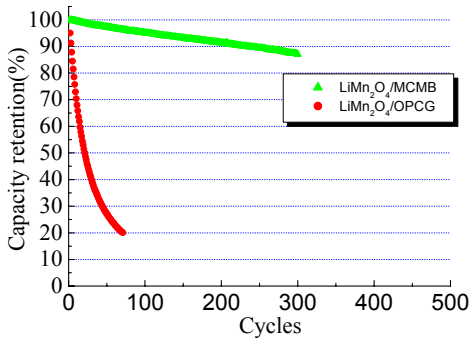

Fig. 2 Cycle life test of $LiMn_2O_4$/MCMB and $LiMn_2O_4$/PCG batteries at room temperature. The electrochemical measurements were carried out in the potential range of 4.2-2.8V with 1C charge-discharge rate.