

Measurement of coulombic efficiency of Lithium Ion Batteries using Ultra High Precision Charge and Discharge system

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High precision charge and discharge system (HPC) was built for accurate measurements of Coulombic Efficiency (CE) of Li-ion battery [1-6]. The current and potential stability of this system is quiet excellent between 1uA to 2000 mA for long period. By using this system, coulombic efficiency (CE) and residual current (RC) under constant voltage of Li-ion batteries were measured under various conditions. In this presentation, we report the change of CE during cycle especially at low temperature and the dependence of residual current on cell voltage.

Commercial cylindrical Li ion batteries (nominal capacity 2800 math) were used in this experiment.

Fig. 1 shows the dependence of coulombic efficiency (CE) on temperature between 10 and 60°C. The current used for measuring of CE is 200 mA (1/14 C). CE decreases with temperature as shown in this figure. CE gradually increases with cycle in temperature range studied. CE also increases smoothly with cycle between 23 and 60 °C. On the other hand, increasing of CE is not so smooth and scattering of CE of every cycle is larger compared with those at higher temperatures and the extent scattering became large with decreasing of temperature. Especially, CE sometimes became larger than 1 at 0°C. It is estimated that this phenomena is caused by the precipitation and dissolution of metallic lithium during cycle especially at lower temperatures. To confirm above estimation, CE measurement of small pouch cell with 20 mAh was conducted at lower temperatures and cell was disassembled to check the precipitation of metallic lithium.

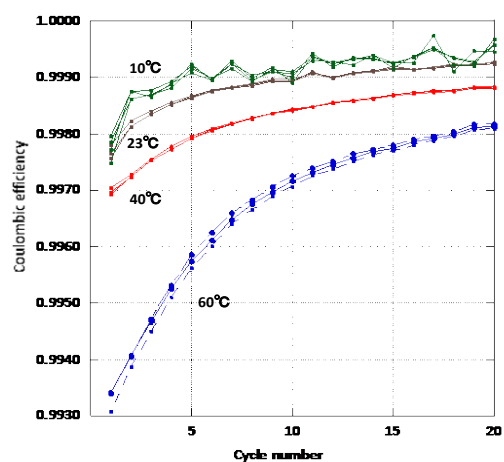


Fig.1 Dependence of CE of commercial cylindrical lithium ion battery on temperature between 10 and 60 °C (Current:200 mA correspond to 1/14C).

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