4. Reliability of small li-ion rechargeable batteries

4-1 Features of the charge/discharge cycle

Small li-ion rechargeable batteries have an excellent charge/discharge cycle life. For general lithium-ion batteries, significant capacity degradation occurs after several hundred to several thousand cycles. But for SLB, the use of lithium titanate in the anode results in long life, as lithium ions are less likely to be consumed by the electrolyte when forming the SEI. Figure 4-1 shows the rate of change in 1C capacity for the ϕ3x7L at a given number of cycles following a charge/discharge cycle test at a current value of 10C. The figure shows that 1C discharge capacity remains at 90% or higher of the initial level even after around 25,000 cycles, confirming the SLB demonstrates extremely favorable cycle properties.

Given the product's excellent cycle properties, it is well suited for use in devices that are charged/discharged several times a day.

* The following data are not guaranteed values.

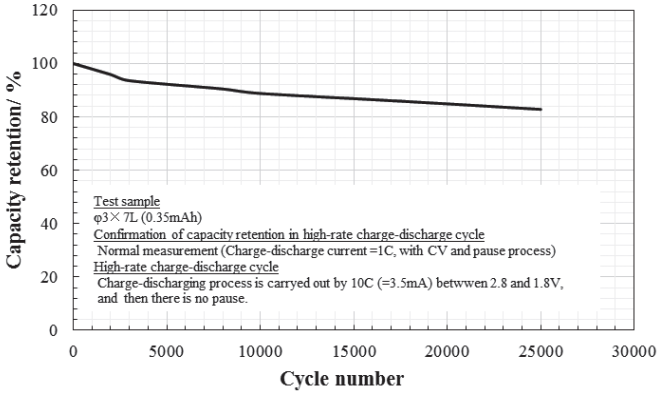

Figure 4-1. Rate of change in capacity of ϕ3x7L during charge/ discharge cycle test at current value equivalent to 10C

4-2 Shelving characteristics

Shelving characteristics refer to a product's capacity characteristics when stored for a long period of time in a charged state and left as an open circuit, with no load attached. In general lithium-ion batteries, degradation occurs as the result of chemical reactions. Usually, storing a battery can cause a decrease in capacity, an increase in internal resistance, or other form of degradation. However, if a battery is stored at a high temperature in a fully charged state, this high-voltage storage can place even more stress on the battery, accelerating its degradation. Figure 4-2 shows the rate of change in 1C capacity when the ϕ3x7L is stored in a fully charged state in high temperature (65°C) and high-temperature/high-humidity (65°C and 95% RH) conditions. When the battery is charged to 100% of capacity and is stored at 65°C, it retains nearly 80% of its initial capacity after 2,000 hours has elapsed. However, when a battery charged to 100% of capacity is stored in high-temperature/high-humidity conditions (65°C and 95% RH), its capacity fell to about 60% of the initial figure after 1,000 hours. This confirms that capacity degradation accelerates significantly when the battery is stored in high-temperature/high-humidity conditions.

The SLB can easily be stored in a highly charged state at high ambient temperatures for an extended period of time. Moisture in the environment will reduce product life significantly, so storage in such conditions is not recommended. If you need to use the SLB in the environment with high temperature and high humidity, please contact NICHICON beforehand.

* The following data are not guaranteed values.

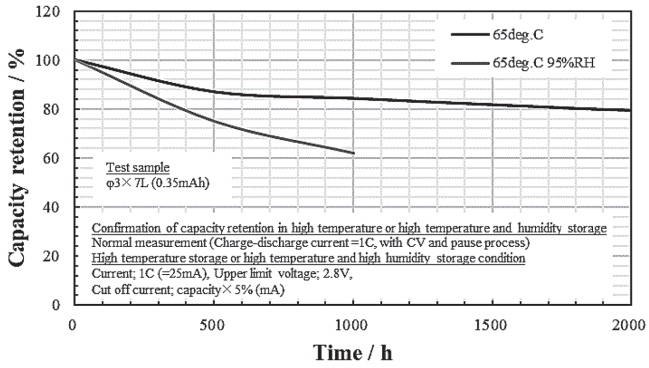

Figure 4-2. Rate of change in capacity of ϕ3x7L in high-temperature and high-temperature/ high-humidity conditions