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Investigation of Cylindrical Lithium-ion Battery Fire Suppression using Liquid-Submerged Technique

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The LIB cells were immersed into Synthetic seawater, DI water and tap water to study possibility of LIB fire suppression. The results indicate slight reduction of battery voltage in DI water and tap water. On the other hand, synthetic seawater provided rapid discharge behavior to 4.05V The cell's voltage could not be measured after 2.5 hours submersion time as shown in Fig. 1.

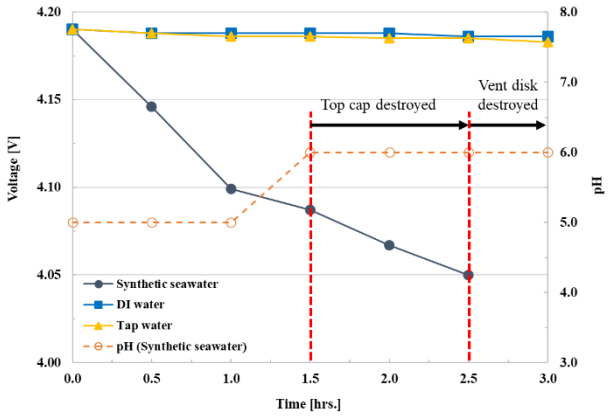

Fig. 1 Cell's voltage versus time curve

The positive terminal of cell submerged in Synthetic seawater was completely corroded after 2.5 hours submersion time as shown in Fig. 2 (a). The cell has lost weight around 1.6 grams due to its serious corrosion on positive terminal. The top cap of positive terminal was destroyed after 1.5 hours submersion time, which can be considered as safety submersion time. After that, the vent disk of positive terminal was completely corroded in 2.5 hours submersion time, resulting in the failure of voltage measurement. However, synthetic seawater submersion still end up with liquid waste problems because it contains product from electrolysis reaction in submerged liquid. Moreover, submersion in synthetic seawater can provide the voltage discharging to reduce the risk of LIB re-ignition. Nevertheless, using seawater as fire suppressant is acceptable in emergency case but the handling of liquid waste after suppression needs to be further considered. Furthermore, DI water is an ideal liquid for LIB fire suppression because of no terminal corrosion occurred as shown in Fig. 2 (b). Tap water is most suitable in practical use for LIB fire suppression because of its low impact on terminal corrosion as shown in Fig. 2 (c). A small weight difference can be observed for the cell in DI water and tap water. However, both DI water and tap water doesn't provide the voltage discharged to reduce the risk of LIB re-ignition.

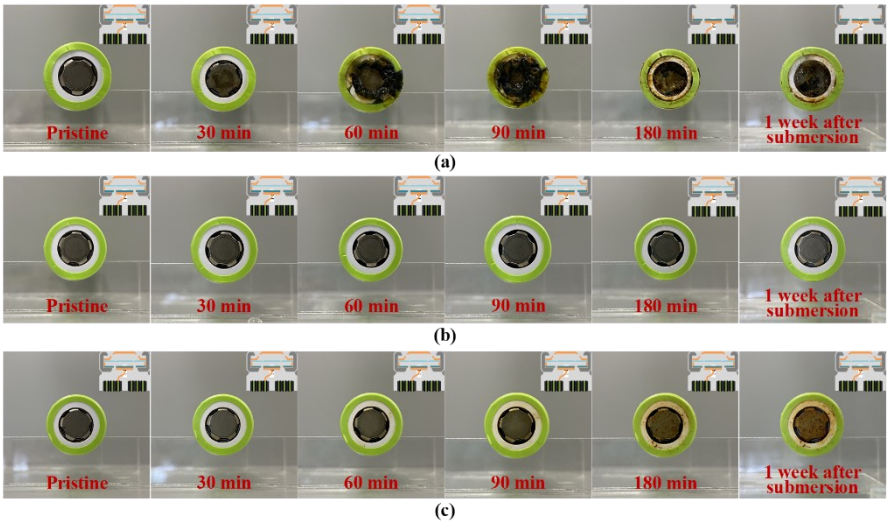

Fig. 2 Positive terminal of the cell submerged in (a) Synthetic seawater (b) DI water (c) Tap water