LITHIUM THIONYL CHLORIDE BATTERIES PASSIVATION

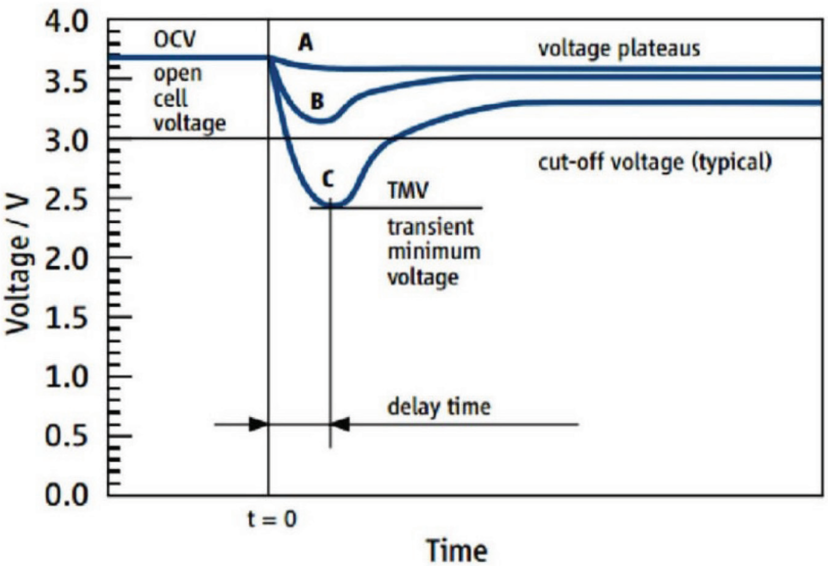
Passivation is a surface protecting reaction which occurs spontaneously in all lithium batteries which are based on a liquid cathode. Passivation prevents the battery from internal short circuit and extends the battery shelf life.

The passivation layer increases the internal resistance causing low voltage levels at a load startup quickly followed by a de-passivation; the cell voltage then recovers to its expected value under the given load. The passivation restarts after the load was removed.

Passivation is mainly affected by temperature and storage / standby time (inactivity time). The passivation layer grows thicker as inactivity time gets longer thus increasing voltage drop time.

Some remedies to avoid complications associated with the passivation:

- Try not to reduce current consumption as much as to prevent the passivation layer from breaking during normal load. The optimum current load allows for a rapid and efficient depassivation. Adding a capacitor to your battery is also an option, the capacitor will store the energy and release it when necessary, permitting smooth de-passivation of the battery.
- If possible, reduce minimal Low Battery warning trigger



The diagram shows the effects of passivation as a function of the required discharge currents. Low or medium discharge currents as depicted by curves A and B would thus not have a great effect on the battery as the operating voltage will drop only slightly before returning to its normal level. However, problems could occur if a lithium thionyl chloride battery is immediately subjected to high discharge currents after a long storage period (curve C). In this case, operating voltage could even drop below the cut-off voltage, thereby causing trouble for the application.

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Summary:

- If your application features high pulses with low frequency; you will be facing a high risk of passivation and disruption of service.

- If your application features high pulses with high frequency, you will have a lower risk of passivation but a high average current, and therefore a high-energy consumption.

- If your application features low pulses and high frequency, passivation shouldn't be an issue.

- And finally, if your application features low pulses and low frequency, the risk of passivation will be moderate, depending on the exact values and of other environmental conditions.

- De-passivation currents prevent re-passivation. As soon as a lithium thionyl chloride battery has been successfully de-passivated, the operating voltage remains constant if current flows regularly. If not, the protective film on the anode's surface will form again. To avoid this re-passivation, specific de-passivation currents are defined for each battery type. For an ER14250 battery, for example, a continuous load current of 15-20 µA is recommended. It is also possible to apply a weekly pulse current of 10 to 15mA over a duration of 10 seconds, or a monthly pulse current of the same intensity over a duration of 60 seconds.

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