CONSIDERING THE CELL DESIGN OF LITHUM ION BATTERIES WITH A PARTICULAR FOCUS ON SAFETY ASPECTS AND PERFORMANCE IMPROVEMENT

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Lithium-ion batteries (LIBs) are widely used as a power source in portable electrical and electronic products [1]. While the rate of failures associated with their use is small, several well-publicized incidents related to lithium-ion batteries in actual use (including fires and explosions) have raised concerns about their overall safety. Test standards are in place that mandate a number of individual tests designed to assess specific safety risks associated with the use of lithium-ion batteries. However, research is currently going on in various laboratories to revise and update existing lithium battery standards to reflect new knowledge regarding lithium-ion battery failures in the field. These organizations are contributing to battery safety research with a focus on internal short circuit failures in lithium-ion batteries. The research is directed toward improving safety standards for lithium-ion batteries. [2,3].

Battery manufacturers and manufacturers of battery-powered products design products to deliver specified performance characteristics in a safe manner under anticipated usage conditions. As such, failure (in either performance or safety) can be caused by poor execution of a design, or an unanticipated use or abuse of a product.

Passive safeguards for single-cell batteries and active safeguards for multi-cell batteries (such as those used in electric vehicles) have been designed to mitigate or prevent some failures. However, major challenges in performance and safety still exist, including the thermal stability of active materials within the battery at high temperatures and the occurrence of internal short circuits that may lead to thermal runaway.

As most of the safety hazards of LIBs relate to the volatile nature of the organic electrolyte and its degradation products, it is essential to understand under which conditions the electrolyte is stable and when it is decomposed. The identification of intermediate and final degradation products of the electrolyte allows assumptions to be made about the degradation mechanism underlying these transformations. The ability to qualitatively and quantitatively – and ideally *on line* – measure the volatile degradation products may represent a possibility to anticipate catastrophic failure of the LIB, and thus to avoid greater damage, contributing thus to a safer use of LIBs for high power applications.

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References

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