Sion Power®

INFORMATION BRIEF

Transitioning from Lithium-Sulfur to Licerion Technology

- Improved cycle life
- Greater energy density
- Increased specific energy
- Enhanced safety

After years of being at the forefront of lithium-sulfur technology advancement, Sion Power shifted to a new chemistry–Licerion technology. The result of such a dramatic shift in chemistry has resulted in the devleopment of a new battery chemistry that is poised to be a market disrupter.

Sion Power's Transition from Lithium-Sulfur to Licerion Lithium-Metal Technology

Sion Power focused its research and development efforts on the advancement of lithium-sulfur (Li-S) battery chemistry during its early history. The Company produced the highest energy density and specific energy Li-S cell in the world. Most notably, Sion Power's Li-S cells were employed in 2014 by Airbus Defence and Space for the Zephyr® 7 HAPS flight, which set a world's record for continuous flight.

However, even with this success, Sion Power was aware of an intrinsic weakness with Li-S that limited its usefulness for most applications. In 2015, Sion Power began research and development work on its next-generation rechargeable cell that overcame the limitations of Li-S.

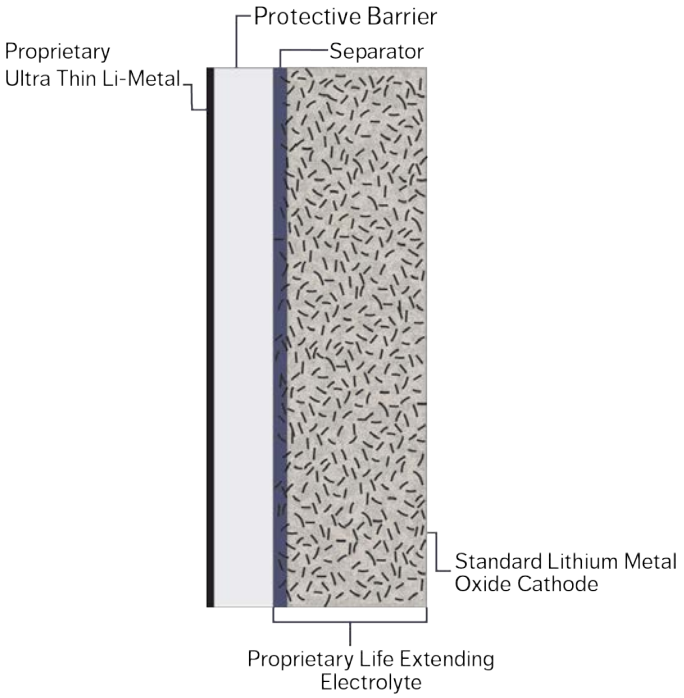
Making the Leap from Li-S to Licerion®

Traditional Li-S cells offer relatively high specific energy (Wh/kg) but are deficient in other key characteristics such as energy density (Wh/L) and cycle life. Sion Power recognized that a better balance between these parameters was necessary in order to address a broad market. The solution was to pair a proprietary lithium metal anode technology with conventional lithium-ion cathodes. By eliminating the cathode graphite, Sion Power achieved the combination of ultra-high energy with long cycle life.

Not the Li-Metal of the '80s

The first attempts to fabricate cells with lithium metal anodes were conducted in the 1980s. Those attempts were unsuccessful at suppressing the formation of lithium dendrites or resistive by-products that caused either hazardous operating conditions or limited cycle life. As a result, the technology evolved away from metallic lithium into the lithium-ion (Li-ion) battery cell. Sion Power has successfully overcome the issues that plagued historical lithium metal chemistries by developing a multi-faceted approach to protecting the lithium metal anode.

Sion Power has developed three levels of protection to enable its Licerion lithium metal batteries — chemical and physical protection within the cell, and physical protection at the pack level. With the patented protected lithium anode (PLA) technology, the lithium metal anode is physically protected by a thin, chemically stable, and ionically conductive ceramic polymer barrier. At the cell-level, electrolyte additives chemically stabilize the anode surface to enhance cycle life and increase energy. The cells do use a liquid electrolyte; however, the amount is negligible compared to traditional Li-ion cells. Finally, the pack incorporates proprietary cell compression and an advanced battery management system (BMS).



Layers of a Licerion cell with chemical and physical protection

Based on the usage profile (charge, discharge rates), Licerion cells can cycle as many as 1000 times. As with any battery cell technology, environmental conditions and drive profiles significantly affect cycle life. However, the cells will remain safe under all normal operating conditions.

In summary

With every more demanding electric mobility energy requirements, a rechargeable energy source is needed that offers the highest combination of energy density, specific energy, cycle life, and safety. The team at Sion Power believes Licerion technology will play a leading role in the advancement of advanced mobility applications.

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