

LithSonic™ - Lithium metal production for the post-lithium-ion battery era

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ABSTRACT

Lithium metal has long been recognised as the ultimate anode material because of its extremely high theoretical specific capacity (3,860 mAh/g) and extremely low redox potential (-3.07 V vs. SHE). However, despite extensive historical efforts to develop a practical rechargeable lithium metal battery, the technical challenges proved insurmountable and the lithium-ion battery (LIB) eventually arose as a compromise. LIBs work by using electrode materials that store and release lithium ions in/from their structure (intercalation/deintercalation) and thereby avoid the use of metallic lithium anodes.

Since their commercial debut in 1991, LIBs have revolutionised portable energy storage and enabled countless dependent technologies including: power tools, mobile phones, laptops, and electric vehicles. Unfortunately, the need for intercalation electrodes has limited the energy density of the battery and, despite incremental improvements, lithium-ion technology is rapidly approaching its theoretical limit. Revolutionary advances will only be possible with new battery chemistries.

Rechargeable lithium metal batteries have come a long way in the last few decades and are now a leading contender as the next-generation battery, provided that the (current) high-cost of lithium metal (USD100/kg), small global market (<5 ktpa), and unappealing electrolytic extraction process do not limit their economic attractiveness and wide-scale adoption. A lithium metal battery revolution requires a lithium metal extraction revolution.

LithSonic™ is a lower-cost, more environmentally friendly technology for the production of lithium metal, derived from CSIRO's magnesium metal extraction process (MagSonic™). By coupling the carbothermic reduction of lithium oxide to supersonic quenching, LithSonic™ can produce lithium metal in powder form, at lower cost, and without the usual emissions of chlorine that arise from the existing electrolysis process (5 kgCl₂ / kg Li).

LithSonic™ is offering a new paradigm for lithium metal production, and thereby enabling the post-lithium-ion battery era.