AUSTRALIAN
critical
minerals
RESEARCH & DEVELOPMENT HUB

# Downstream value chain

The Australian Critical Minerals Research and Development Hub is developing the intellectual property and knowhow needed to help downstream industries produce high purity metals and materials. One of those metals is lithium.

## Why are we researching lithium processing?

Lithium-ion batteries are highly energy dense, making them suitable for weight and size sensitive applications such as EVs, electric bikes and mobile phones.

The global demand for batteries is set to quadruple by 2030 as the world transitions to net zero. Australia is already a leading producer of battery minerals, providing approximately 45% of the world's lithium in 2023. However, we currently make less than 1% of global battery materials or components.

The next generation of high energy density solid state batteries will require lithium metal, which is expensive, with a limited supply.

The current industry method to produce lithium metal using molten salt electrolysis is largely unchanged since 1923, is expensive, energy intensive, low production intensity and can be environmentally damaging.

Australia has an opportunity to take advantage of its significant lithium deposits and global demand if we can develop new technology to produce lithium metal in a cost and energy-efficient way to high ESG standards. This will enable Australia to contribute to the diversification of global supply chains.

## What are we doing?

CSIRO is using rocket science in an innovative and sustainable alternative to produce lithium metal. The CSIRO-patented lithium metallisation process is called LithSonic™.

LithSonic™ is an adaptation of the MagSonic™ process, which CSIRO has been developing since 2003.

The process uses carbothermal reduction – just like iron production from iron ore – and involves the direct reaction of a metal oxide with carbon to produce the metal, i.e.:

$Li_2O + C = 2Li(g) + CO(g)$

Although the theory is simple, the application is complex.

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Gas reaches sonic velocity at the throat of the nozzle.

The reduction requires temperatures >1600°C and the product is a vapour mixture that tends to revert to the starting materials as it cools. By accelerating the gas to supersonic speeds through a special nozzle, like a rocket engine, it then cools at more than a million degrees per second, 'freezing' Li metal in a non-equilibrium state and limiting reversion.

The research team has received funding from the Australian Critical Minerals Research and Development Hub through the downstream value chain project to scale up the technology through the design and testing of the LithSonic™ mini-plant.

## What is the aim?

LithSonic™ has the potential to revolutionise lithium metal production. The aim of this sub-project is to demonstrate the process in a mini-plant (at kg scale) and provide the data for further scale-up of production of commercial purity lithium metal and lithium metal powder for advanced applications.

Developing the intellectual property for a downstream lithium processing industry offers a cleaner and cheaper lithium metal production process and significant environmental benefits to meet growing demand.


The key to this innovative technology is in the nozzle and the mini-plant being tested.

*This work has been supported by the Australian Critical Minerals Research and Development Hub whose activities are funded by the Australian Government.*

**Learn more**

**Contact us**

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