FREQUENTLY ASKED QUESTIONS

GENERAL

When was Li-Metal Corp. founded? Can you discuss the history?

Li-Metal Corp. was founded in 2018 by Maciej Jastrzebski and Tim Johnston to address an emerging and prevailing underlying trend in the electrification of transportation – the transition from conventional lithium-ion batteries, to next-generation high-performance batteries such as solid-state, hybrid liquid electrolyte and lithium-sulphur.

Before its inception, while Li-Metal Corp. was just an idea being discussed over lunchtime chats in Toronto between these two former Hatch engineers, the concept was originally intended to address the demand for lithium metal in the North American market. Naturally, this company was named "Li-Metal" an abbreviation of "lithium metal."

Driven by the insight of the opportunities arising from next-generation batteries technologies under development, they knew a dramatic reshaping of the next-generation battery supply chain would be required. This propelled the idea forward as it evolved into a more holistic vision to tackle both the lithium metal opportunity and the need for high-performance, low-cost anode materials.

Fast forward to present day, Li-Metal is working at the forefront of the next-generation battery supply chain, developing and commercializing production technologies to help enable cheaper, cleaner and better-performing batteries. Since its founding, Li-Metal has made significant progress, including going public on the Canadian Securities Exchange, likely becoming the first company in the world to produce lithium metal from lithium carbonate at our pilot plant in Ontario, commissioning an anode demonstration pilot plant in the United States, which produces thousands of metres of sample material per year, and **we are just getting started.**

What does Li-Metal do?

Li-Metal is an innovator and supplier of advanced battery materials to the next-generation battery ecosystem. We are commercializing two core production technologies: 1) a lithium metal technology and 2) a next-generation battery anode technology. Using these technologies, Li-Metal is able to produce lithium in its metallic form, or solid lithium, and advanced anode materials.

Li-Metal's technologies and advanced battery materials support automakers and battery developers in producing electric vehicle (EV) batteries that are lighter, less expensive and can take people further. We are not stopping at EVs either, as our technologies have the potential to play a key role in unlocking the future of other transportation applications, such as electric aviation.

Ultimately, our vision is to become a reliable, local supplier for lithium metal and next-generation battery anode materials to the North American and European markets.

THE INDUSTRY

What is lithium metal and what is it used for?

Lithium metal is the lightest metal and has the highest electrochemical potential of all the elements on the periodic table. It's widely considered to be the 'Holy Grail' of battery materials because it has the ability to dramatically increase the energy density and specific energy of a battery, especially compared to graphite (the material used in today's lithium-ion batteries).

Outside of the next-generation battery industry, lithium metal is a strategic material that has yet to reach its full potential as its use in applications has been limited to-date. In line with its limited use is a very limited supply – especially in North America and Europe – which could create a scramble to establish capacity in the years to come. Currently, there are only several thousand tonnes of lithium metal produced globally with 90% of that production concentrated in China. Outside of the next-generation battery market, the material is primarily used for specialty industries, including alloys, chemicals, aerospace, pharmaceuticals, and primary batteries (*i.e. a Duracell battery*).

An important distinction is the lithium metal that Li-Metal produces is lithium in its metallic form – or solid lithium – and not lithium hydroxide or lithium carbonate, which are the lithium compounds currently in the spotlight due to their use in the cathode materials of today's lithium-ion batteries. Currently – outside of the battery industry – if you hear someone refer to the term "lithium" odds are they are referencing one of these lithium compounds.

What is a battery anode?

Today's lithium-ion batteries typically consist of four main components: a cathode, an anode, an electrolyte, and a separator. The cathode and the anodes are electrodes that transport electrons between each other to produce an electrical charge, which enables the battery to power all types of applications from cell phones, to electric vehicles, to large energy storage plants and everything in between.

While the cathode is the positive charge, the anode is the negative charge. The anode stores electrons and sends them to the cathode to allow a current to flow through an external circuit in a battery. When a battery is fully charged, all of the electrons are in the anode and when the battery is being used, they flow through to the cathode. At 100% charge all the electrons are in the anode and at 0% they are in the cathode. Traditionally, anode materials for conventional lithium-ion batteries are typically made of graphite coated on a copper foil.

What are next generation batteries? How are they different than lithium-ion batteries?

In many ways, the term "next-generation battery" is an umbrella term for a wide variety of advanced batteries that are under development, but have yet to be commercialized or hit the market in mass.

Examples of these batteries are solid-state lithium metal batteries, hybrid liquid electrolyte batteries, lithium-sulphur batteries, and silicon anode batteries.

Similar to the current lithium-ion battery that powers your cell-phones, laptops and the EVs we see on the road today, next-generation batteries – generally – all contain a cathode, an anode, a type of electrolyte and a separator similar to their predecessor.

Most of these next-generation batteries are still in the research and development and although they are not all the same, they all have one central purpose – to improve EVs in terms of cost, sustainability, storage, safety, and most importantly, performance. These new batteries can not only supercharge EVs, they have the potential to unlock new methods of transportation as many of them are lighter batteries with improved energy density, which is key for specialty battery powered applications, such as electric aviation.

Many of these battery improvements will come from changes to the anode, which is core to the foundation of the battery. This is why the widespread adoption of these batteries will require a dramatic reshaping of the battery supply chain as we know it.

WHO WE WORK WITH

Can you discuss how you fit into the broader battery ecosystem? Are you a battery developer?

Our overall process starts with lithium carbonate as feedstock – or input material – and ends with rolls of high-performance lithium metal anodes ready to go into battery cells. We are a customer of the chemical producers and a supplier to battery developers.

Li-Metal can be thought of as a 'Tier 2' supplier to the automotive industry and other industries powered by batteries. An important distinction for Li-Metal is that **we are not a battery developer or manufacturer**. We are a producer of advanced battery components, but do not make the battery cells ourselves. We believe this provides us with favorable positioning as there are already a host of next-generation battery developers making significant traction in progressing their technologies. We believe this will accelerate demand for our advanced battery materials and we look forward to supporting – not competing with – our current and perspective next-generation battery customers and partners.

Who are your customers or perspective customers?

As we position ourselves as a reliable lithium metal supplier, we could potentially supply any organization in demand of this strategic material in addition to our own anode operations. This includes next-generation battery developers in addition to companies working with alloys, specialty chemicals, pharmaceuticals, primary batteries, aerospace and more.

On the anode side of the business, our target customers are battery developers and automakers. We currently have ongoing discussions with 27 battery developers and automakers, 15 of which are sampling our anode materials in next-generation batteries to qualify our technology.

We also have an exciting joint development and commercialization agreement with Blue Solutions (a subsidiary of the multibillion dollar French company Bolleré SA) to advance lithium metal solid-state batteries for passenger EVs. Blue Solutions is a pioneer of solid-state batteries and, most notably, their batteries power Daimler eCitaro electric buses in Europe. Our partnership marries proven solid-state experience with innovative anode technology as, together, we work to enable next-generation batteries for EVs.

TECHNOLOGIES AND PRODUCTS

Can you give an overview of the technologies?

Li-Metal's patented lithium metal technology produces metal directly from lithium carbonate, and our anode technology uses a roll-to-roll physical vapor deposition (PVD) technology to apply vaporized lithium metal on a substrate to build next-generation battery anodes from the "bottom up.'

Our production technologies are vertically integrated as our lithium metal technology provides feedstock for our anode production technology.

Can you describe your lithium metal technology?

Traditionally, lithium metal has been produced using lithium chloride as feedstock, which generates approximately 5 tonnes of harmful chlorine gas by-product for every tonne of lithium metal produced. Lithium chloride is typically made by treating lithium carbonate, however, Li-Metal is able to eliminate this costly conversion step by taking lithium carbonate, as recycled or virgin powder or granules, and dissolving it in a molten salt bath. Then, this is electrolyzed in a membrane electrowinning cell, which splits the lithium carbonate into technical grade lithium metal and off gas. In other words, we pass an electric current through the molten salt solution and isolate the technical-grade lithium metal. Utilizing our proprietary process, we can refine the technical grade lithium metal to produce high-performance, battery-grade metal.

Overall, we believe our cleaner and improved lithium metal production process is cost-effective, energy-efficient and we avoid producing toxic by-products. Furthermore, in addition to eliminating the costly conversion step to produce lithium chloride, we don't need to build and operate sophisticated gas treatment equipment to handle chlorine gas emissions.

Additionally, with most lithium metal production based in China – our ability to deploy our modular and scalable process in North America and Europe will enable us to become a highly sought after domestic supplier for the next-generation battery industry in these target markets.

Can you describe your anode technology?

Before Li-Metal, the existing technologies for producing next-generation anodes faced significant challenges. Conventional anodes are made by pressing and rolling lithium metal into foils. The problem is that foil rolling is difficult to scale, especially as the foil gets very thin, which is what next-generation battery developers are seeking. Furthermore, because it is difficult to customize the thickness of foils, the energy density is reduced. To add to all of these challenges, excess lithium, produced as a result of traditional manufacturing processes, contributes to the combustibility of the battery, which increases the risk of a fire, impacting safety.

Li-Metal is focused on solving these challenges with its roll-to-roll PVD anode technology. PVD is a ubiquitous technology and anything that looks metallic, but is made of plastic is likely made from a PVD process, such as the shiny metallic coating inside a bag of potato chips. This technology, in other industries, has been able to produce millions of square metres of low-cost materials for decades and we are applying this proven technology platform to produce advanced anode materials for the next-generation battery industry.

Technically speaking, we use a one-pass double-sided roll-to-roll deposition approach as micron-scale material starts on a substrate roll, unwinds, then passes through a treatment zone where lithium metal (which we plan to produce ourselves) or a combination of materials is deposited. This is then collected on the product roll, to produce the final anode product, which can be used directly in new batteries. In other words, we are able to apply vaporized lithium metal on the substrate roll to build these anode materials from the 'bottom up.'

Using our PVD approach to anode production – in many ways – is almost the opposite of the traditional approaches of squeezing, flattening or pressing a piece of lithium metal down to the thickness we want; instead we build it up by depositing lithium metal directly on the current collector. By building these lithium metal films from the bottom up, we minimize the amount of lithium metal used in our process, which reduces excess lithium to improve safety. This also increases the cost-effectiveness of our process by limiting waste of a highly valuable feedstock. Not only does our process allow us to minimize the amount of lithium used, it also allows us to co-deposit other materials to enhance the performance of our anode materials, as we eliminate the need for graphite in battery anodes.

At our advanced anode pilot plant in Rochester, New York, we have proven our ability to produce lithium metal anode products with lithium thickness between 3 and 25 micrometres, as we continue to customize our offerings to meet customer demand. Furthermore, through our work in Rochester, we believe we are operating the highest intensity PVD lithium metal anode process in the industry. In other words – we believe our PVD process operates at an unmatched efficiency rate in the next-generation battery industry.

Our work with PVD technology is just getting started as this highly flexible technology platform can be upgraded to accommodate unique combinations of materials to optimize cost and electrochemical performance, unlocking a suite of future product development opportunities.

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