July 24, 2018

Zacks Small-Cap Research

Sponsored – Impartial - Comprehensive

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Alpha-En Corp. (ALPE-OTCBB)

Zacks Initiates Coverage of alpha-En Corp.

Calculating the net present value of a future target price (which is based on price-to-sales) in 2025 when we expect the company to achieve risk-adjusted revenues of $93.7 million indicating a current NAV share price target of $3.70.

Current Price (07/23/18)	$1.86
Valuation	**$3.70**

OUTLOOK

alpha-En is in the development stages of advancing both its proprietary **lithium metal manufacturing process** and **thin-film lithium anode metal deposition process** toward commercialization. The company is embarked upon the preliminary steps to scaling-up the development and manufacturing design of both processes. alpha-En has entered into research agreements with **Princeton University**, **Argonne National Laboratory** and **Cornell University** so that battery manufacturers can properly consider alpha-En's technology for inclusion into the next generation of batteries with lithium metal anodes.

SUMMARY DATA

52-Week High	**$4.35**
52-Week Low	**$1.19**
One-Year Return (%)	**-7.00**
Beta	**3.44**
Average Daily Volume (shrs.)	**2,464**
Shares Outstanding (millions)	**33.358**
Market Capitalization ($ mil.)	**$59.71**
Short Interest Ratio (days)	**N/A**
Institutional Ownership (%)	**0**
Insider Ownership (%)	**66**
Annual Cash Dividend	**$0.00**
Dividend Yield (%)	**0.00**
5-Yr. Historical Growth Rates	
Sales (%)	**N/A**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/M**
P/E using 2018 Estimate	**N/M**
P/E using 2019 Estimate	**N/M**

Risk Level	**Above Average**
Type of Stock	**Small-Growth**
Industry	**Technology Services**

ZACKS ESTIMATES

Revenue
(in millions of $)

	Q1 (Mar)	Q2 (Jun)	Q3 (Sep)	Q4 (Dec)	Year (Dec)
2016	0.0 A	0.0 A	0.0 A	0.0 A	0.0 A
2017	0.0 A	0.0 A	0.0 A	0.0 A	0.0 A
2018	0.0 A	0.0 E	0.0 E	0.0 E	0.0 E
2019	0.0 E	0.0 E	0.0 E	0.0 E	0.0 E

Earnings per Share

	Q1 (Mar)	Q2 (Jun)	Q3 (Sep)	Q4 (Dec)	Year (Dec)
2016	-$0.03 A	-$0.07 A	$0.00 A	-$0.02 A	-$0.12 A
2017	-$0.05 A	-$0.06 A	-$0.07 A	-$0.06 A	-$0.24 A
2018	-$0.07 A	-$0.04 E	-$0.04 E	-$0.04 E	-$0.19 E
2019					-$0.18 E

Zacks Projected EPS Growth Rate - Next 5 Years % **N/A**

KEY POINTS

- alpha-En Corporation is **focused on enabling next-generation battery technologies** through the development of processes that target significant performance advances for lithium batteries, specifically the production **of very high purity lithium metal** through a patent-pending novel process. Also, the same production process, which is currently in the development stage, appears well-suited for the **production of lithium metal anodes**, a critical component of the next generation rechargeable lithium batteries.
    - The company's very high purity lithium metal production process under development has multiple advantages over the current lithium production technique, namely the traditional ingot method which involves the electrolysis of molten salts at high temperatures (at and above 400° C). alpha-En's process occurs at 25° C, which **meaningfully reduces production costs**. The alpha-En process also does not produce chlorine gas as a by-product, **eliminating costs associated with hazardous chemicals**.
    - alpha-En's electrolytic deposition process yields a layer of **extremely pure lithium metal** onto a range of different conductive substrates. The deposited lithium layer is without nonconductive impurities and with a dramatically reduced presence of trace metals/undesired substances (**up to 99.997% pure lithium metal in laboratory tests**). The purity of lithium anode material is expected to be a key element to the successful development of a lithium anode battery.
    - alpha-En's process permits precise control of lithium morphology for the **formation of a well-defined, densely-packed and uniform nanostructure**. An ordered nanostructure of the lithium metal anode is expected to improve mechanical stability of the anode, **enhance the electrochemical process**, **improve cycling characteristics** and **suppress the formation of dendrites**. All these benefits are in addition to the **leap in energy density** from utilizing a lithium metal anode.
- alpha-En is engaged in collaborative research programs with the academic and scientific institutions of **Princeton University**, **Argonne National Laboratory** and **Cornell University**
    - Argonne National Laboratory is helping advance alpha-En's technology through **further process optimization** and by assisting the transition of the **manufacturing process** from batch to commercial scale
        - In September 2017, Argonne was granted a $750,000 award from the DOE to help commercialize a solid-state electrolyte coating, which is being tested in conjunction with alpha-En's lithium metal process to produce a next-generation battery.
    - In May 2017, alpha-En opened its own **laboratory in Yonkers**, NY. The lab has successfully completed the permitting process and is fully operational.
    - From a prior cooperative research program with **The City University of New York** (CUNY), an important research article entitled "High-Purity Lithium Metal Films from Aqueous Mineral Solutions" was published in January 2018.
    - In July 2018, **Cornell University** entered into a Cooperative Agreement to conduct sponsored research on alpha-En's lithium thin film production process. The research project is focused on quantifying the thin film's capacity and providing a visual, real-time demonstration of the deposition process so that battery manufacturers can properly consider alpha-En's technology for inclusion into the next generation of batteries.
- Management is also pursuing other research projects to broaden the application of the company's core technology into new viable commercial opportunities in other associated energy storage products and services, such as recycling and high purity lithium compound production, e.g. lithium hydroxides, lithium chlorides and lithium carbonates.
- The company continues to **build awareness** by attending **Analyst Conferences** and **Industry Forums**:
    - Sidoti & Company Fall 2017 Conference (September 28, 2017)
    - Murdock Capital Partners Conference in NYC (December 6, 2017)
    - 2018 NAATBat International Conference in San Antonio (March 20-22, 2018)
    - MicroCap Conference in NYC (April 9-10, 2018)

- Management intends to pursue licensing and joint venture (JV) opportunities with battery suppliers, makers and users in all the major realms of lithium rechargeable batteries (electronics, electric vehicles and energy storage).

OVERVIEW

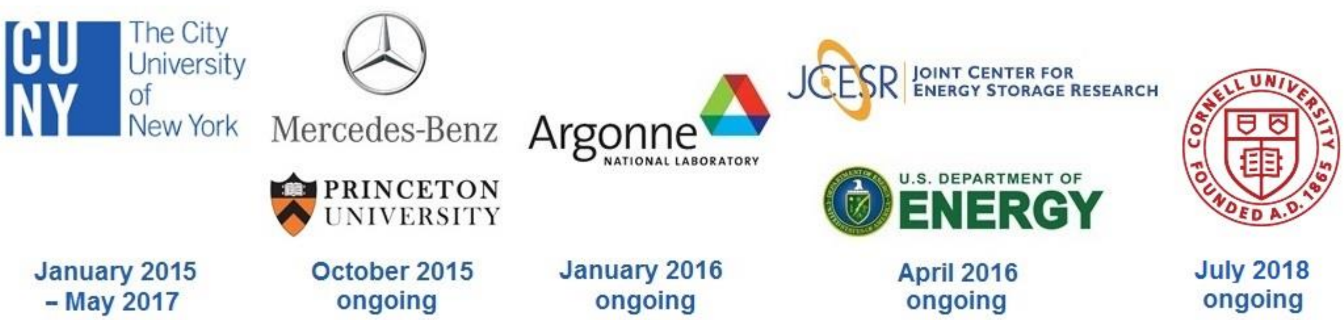
Alpha-En Corp is a **technology development company**, primarily focusing on the development of a commercially viable process for the **production of high-purity lithium metal** and of a **thin film lithium anode** for use in the next generation of lithium high-energy batteries. The company's core intellectual property (several patent applications and licenses) are held by Clean Lithium Corporation (CLC), a wholly owned subsidiary of alpha-En. The patent portfolio has been broadened and strengthened since 2013 and now includes filings for several international markets (Australia, Canada, China, Europe, Japan, India, Korea and Hong Kong).

The company's development programs are pursuing several opportunities as the lithium battery market evolves toward lithium metal and solid state batteries:

- **Production process of high-purity lithium metal**
    - Patent-pending process to produce **<u>high-purity</u> lithium metal** at room temperature without toxic chemicals. Not only is the method dramatically lower in cost than conventional high temperature production processes, the lithium metal produced is very pure with respect to base metals content, which is considered an important pathway toward the next generation of lithium batteries.

- **Thin-film lithium anode**
    - Among the technological advancements being pursued to produce the next generation of lithium batteries is the use of a **lithium anode**. Most lithium batteries today utilize a carbon anode, usually in the form of graphite. Alpha-En has a thin-film lithium anode process under development that appears superior to other lithium anode alternatives, especially by helping surmount a major technological hurdle (the formation of dendrites).

- Pursuit of using the company's lithium purification process in the **lithium recycling industry**
    - The recycling process produces a pregnant leach solution with dissolved lithium carbonate and other lithium salts, which are suitable feedstock for the company's process to produce high-purity lithium metal.



Strategic Research Partnerships

Management pursues potential research, licensing and manufacturing partners to help accelerate the process of commercializing the lithium processes and products that the company is developing. Currently, alpha-En is engaged in collaborative research programs with academic and scientific institutions of **Princeton University**, **Argonne National Laboratory** and **Cornell University**. In order to enhance its internal development program, the company opened its own **laboratory in Yonkers**, New York on May 31, 2017. The permitting process was completed in April 2018, and now the laboratory is fully operational and capable of manufacturing samples for research partners and potential customers.

Under a cooperative research program that began in January 2015, **The City University of New York** (CUNY) conducted research on behalf of alpha-En. The CUNY verified the patent claims, replicated alpha-En's high-purity lithium metal production process, manufactured samples and advanced the IP portfolio further.

In April 2016, alpha-En became an affiliate member of the **Joint Center for Energy Storage Research** (JCESR), a public/private research consortium established by the Department of Energy in 2012. The organization focuses on creating the next-generation battery technologies by promoting collaboration among government, academic and industrial researchers. Partner organizations include Argonne National Laboratory, Dow Chemical, Northwestern University, United Technologies and the University of Michigan. In addition to the 15 partner organizations, there are five funded collaborators (Harvard, MIT, University of Notre Dame, University of Utah and University of Waterloo). In order to accelerate innovation, the affiliate program gives more than 100 small and large businesses (including alpha-En), non-profits, universities and national laboratories, the opportunity to engage with research projects and network with each other.

In July 2018, alpha-En and **Cornell University** entered into a Cooperative Agreement to conduct sponsored research on alpha-En's lithium thin film production process. The research project is focused on creating a better understanding of the electrochemical properties of alpha-En's thin film lithium metal deposition process, particularly in terms of quantifying capacity and providing a visual, real-time demonstration of the deposition process so that battery manufacturers can properly consider alpha-En's approach as part of their development of next generation of rechargeable batteries that utilize a lithium metal anode.

PARTNERS

Alpha-En has entered into strategic research agreements with The City University of New York, Princeton University and Argonne National Laboratory in order to further develop the company's technology, advance it toward commercialization and ultimately to the manufacturing process scale-up of production

The City University of New York (CUNY)

On January 15, 2015, alpha-En entered into a sponsored research agreement with The City University of New York. Research was initially conducted at CUNY's Advanced Science Research Center and later at CUNY's newly constructed Center for Discovery and Innovation. As early as April 2015, alpha-En process was demonstrated at CUNY. From the collaboration, a PCT patent application (PCT/US2016/064328) entitled "Method for Producing a Lithium Film" was jointly filed on December 1, 2016.

When alpha-En opened its own laboratory in Yonkers, New York on May 31, 2017, the sponsored research with CUNY ended; however, subsequently an open access article entitled "High-Purity Lithium Metal Films from Aqueous Mineral Solutions" was published on January 8, 2018. The article was co-authored by five scientists, including two from alpha-En (Larry Swonger and Emilie Bodoin).

Princeton University/Mercedes Benz

In November 2015, alpha-En signed a contract for a sponsored research project with Princeton University. Conducted at Princeton's Andlinger Center for Energy and the Environment, development work on alpha-En **lithium production process** delved into the specific deposition and transport mechanisms enabled by the alpha-En process.

In August 2017, the company entered into a joint research program with Mercedes-Benz Research and Development North America and Princeton University under the supervision of Professor Daniel Steingart, Ph. D. Also conducted at the Andlinger Center for Energy, the research program is investigating alpha-En's **pure lithium metal thin film technology**, particularly with respect to how a thin film's nanostructure could potentially improve cycling performance within a battery cell and ultimately its commercial potential for inclusion in the next-generation of electric vehicle batteries.

Argonne National Laboratory

In January 2016, alpha-En entered into a collaborative Cooperative Research and Development Agreement with Argonne National Laboratory. The partnership with Argonne is expected to expedite the commercialization process of alpha-En's lithium thin film effort by helping to optimize alpha-En's process to produce high purity **lithium metal anodes** for the next-generation rechargeable batteries. The management of alpha-En anticipates that the partnership will result in improving yield and a roadmap for scaling of the manufacturing process from the current batch production to commercial scale.

In addition, the company's partnership with Argonne National Laboratory provides access not only to world class scientific experts, but also to Argonne's network of partners, including energy companies, battery manufacturers and Federal/State sponsored battery testing facilities.

Argonne National Laboratory is the largest national laboratory in the U.S., having been created out of the University of Chicago's work on the Manhattan Project in the 1940s. Argonne is managed by UChicago Argonne, LLC for the U.S. Department of Energy's Office of Science and works in concert with private and public companies, universities and other national laboratories. Argonne focuses on working with manufacturers to enhance the technology-to-market process and has a proven track record for advancing next- generation technologies.

On September 15, 2017, alpha-En announced that Argonne National Laboratory was granted a **$750,000 award** from the U.S. Department of Energy's Office of Technology Transition Technology Commercialization Fund. The award from the DOE is to be used to commercialize Argonne's proprietary highly conducive solid-state electrolyte coating in conjunction with alpha-En's lithium metal anode for a next generation battery integration. This competitive award is granted to applicants in the private sector in order to advance new promising energy technologies for commercial purposes. The award is matched with an equal amount from private partners.

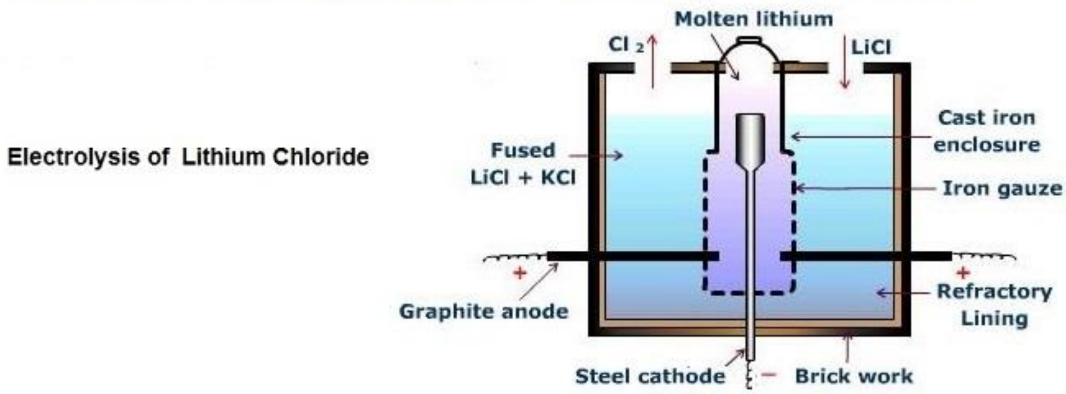
Cornell University

In July 2018, alpha-En and Cornell University entered into a Cooperative Agreement to conduct sponsored research on alpha-En's patent-pending **lithium thin film production process**. The research, which is expected to last a few months, is to be conducted at the Baker Laboratory by the Abruña Group under the direction of Professor Héctor D. Abruña, who was recently elected a member of the National Academy of Sciences. The group focuses on the development and characterization of new materials for several energy conversion applications, including batteries, with particular emphasis on using computational tools to better understand the electrochemical properties of molecules and materials**.** In this specific project, the research is anticipated to provide insights into the characteristics of alpha-En's thin film lithium metal deposition process, especially in terms of **quantifying capacity**. The Abruña Group also has the unique capabilities and tools to study **the ion transport process** on a microscopic scale in real time (*in operando*) during the time period of thin film growth. A successful demonstration of alpha-En's unique thin film lithium metal deposition process would be most useful for battery manufacturers to consider in their development of the next generation of rechargeable battery with a lithium metal anode.

ALPHA-EN TECHNOLOGY - PRODUCTION PROCESS OF HIGH PURITY LITHIUM METAL

The **current process for the industrial production of lithium metal** has not changed significantly since 1891. The process, known as **electrowinning**[i], produces lithium metal through electrolysis of molten salts at a working temperature at and above 400° Celsius or 752° Fahrenheit (the exact temperature is largely governed by the exact electrolyte salt used). Most commonly, the lithium salt of lithium chloride (LiCl) is fused with potassium chloride (KCl) and subsequently electrolyzed at a temperature of over 800°F as 8-to-9 volts are applied. Molten lithium (Li) forms and rises at the steel cathode (being captured and preserved in paraffin wax) while chlorine gas (Cl2) is liberated at the graphite anode.

Traditional Inefficient Method of Producing Metallic Lithium



This **time-consuming process** (over 24 hours) is **energy-intensive**, which contributes to a **high cost of production**. Chlorine gas is generated by the reaction and must be continuously discharged from the system. In addition, the purity of the lithium metal is subject to contamination by the components of the salt(s), only allowing the lithium metal produced to attain a maximum purity of 99.0% Li (a purity level that inhibits the development on next generation lithium metal batteries). Also, there is little control over the microstructure of the metallic lithium produced.

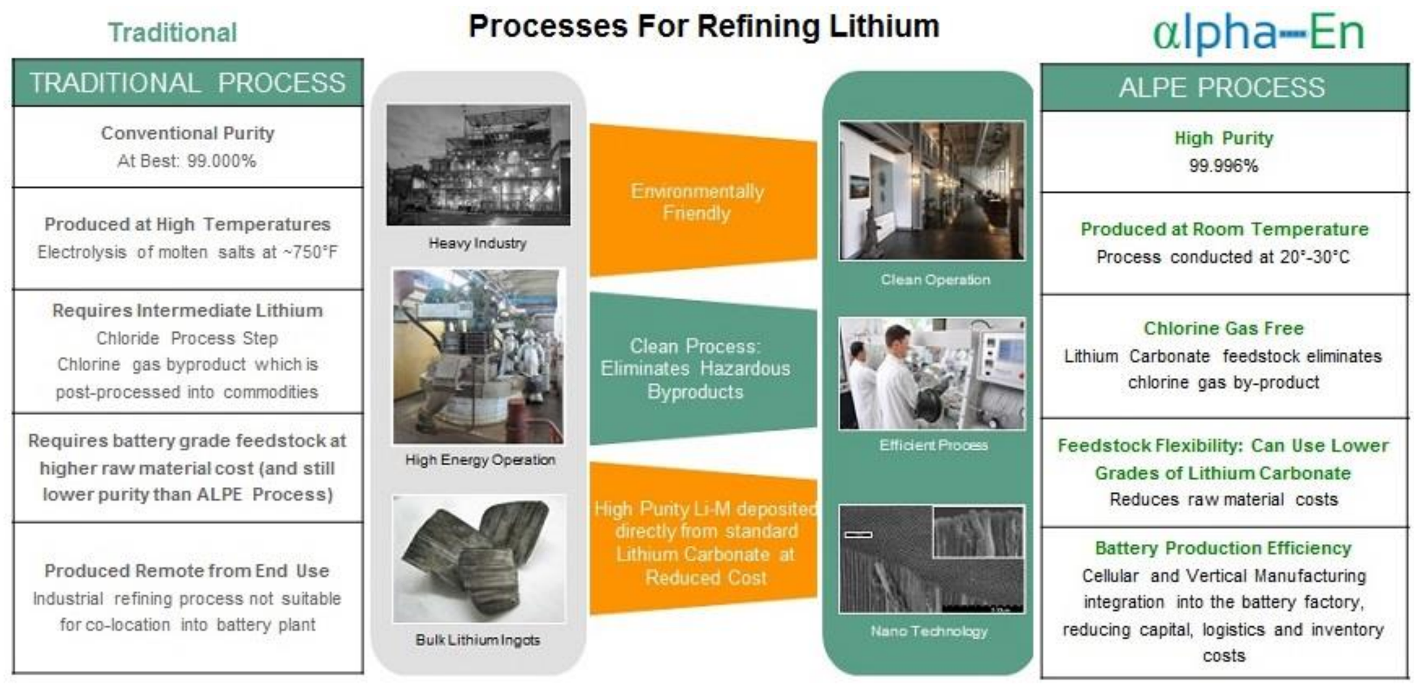
Much research has been conducted for a process of lithium production at lower temperatures. However, one process requires not only the use of **mercury** for lithium extraction, but also large amounts of mercury. The inherent environmental risk profile is intolerable. Case in point, the COLEX process, which separated and enriched lithium-6 and lithium-7 for the nuclear weapons program starting in 1955, was outlawed in the United States in 1963. COLEX utilized a mercury cathode and during the process formed an amalgam of lithium and mercury. Another low temperature process uses halide salts of lithium, which releases **chlorine gas**[ii] as lithium is separated from the lithium salt. In these proffered lower temperature processes, the use and handling of mercury or the capture, containment and remediation of the chlorine gas byproduct increases the environmental risks and production costs.

The Alpha-En Process of Producing High-Purity Metallic Lithium

alpha-En has developed a new process technology to produce high-purity lithium metal with a cost effective method (at room temperature) and in an environmentally friendlier manner without the use or emission of toxic/hazardous products (mercury/chlorine). This disruptive technology is highly differentiated from current conventional lithium extraction techniques by offering **several significant advantages**.

- Process temperature of only 25° C – room temperature (lower manufacturing costs)
- Feedstock of lithium carbonate or other lithium mineral salts (lower production costs)
- Produces high purity lithium with respect to base metals content (up to 99.997% in laboratory tests)

- Flexible process that is able to deliver lithium in a variety of desirable form factors for thin film applications
- No necessary use of halide salts (eliminating the emission of chlorine gas)
- No use of mercury
- No need to handle molten lithium salts



Attributes of a Disruptive Technology

alpha-En's innovative process not only has a friendly environmental footprint and lowers operating costs, but also has **disruptive technological attributes** of very high-purity metallic lithium along with the flexibility to adjust the morphology from amorphous to a uniform nanostructure depending on the application. In the quest for the next generation lithium battery, which most scientists consider a viable lithium anode, the enabling technologies appear to be the purity and/or the structure of lithium deposited on the anode's substrate. **Very high purity lithium** with respect to base metals content, with well-defined morphologies and reduced surface roughness, may be the key to dramatically inhibit dendritic growth, which is thought to be the main cause of capacity loss/reduced cycle life in lithium metal anode battery technologies. It also appears that the degree of improvement in the next generation of high energy density lithium batteries can be enhanced through the use of **nanostructured lithium electrode materials**. Alpha-En's process is flexible and has the capability for the manufacture of lithium metal with a relatively uniform nanostructure, which could be a crucial element for the successful advancement and commercialization of the lithium metal anode.

Alpha-En has advanced its process of manufacturing metallic lithium through the early stages towards commercialization.

- Bench-scale testing in the laboratory at CUNY.
- Independent validation of proof of process at CUNY, Princeton and Argonne National Labs.
- Production of samples for potential partners and customers on a batch scale at Argonne National Labs.

Management continues to refine and advance the commercialization process through the following stages:

- Expand size and improve yields of current batch scale process.
- After samples are evaluated and approved by intended customers, a prototype production system is designed and tested in a simulated operational environment.
- Design and operate demonstration scale unit.
- Pilot scale production (pre-commercial system).
- Full scale commercial production.

At any time in the commercialization process, management may negotiate a commercial license and/or enter into production agreements to facilitate or accelerate the advancement of the company's core technologies.

THE OPPORTUNITY

Rechargeable lithium-ion batteries have become ubiquitous, powering electric vehicles (EVs), grid-scale energy storage units and portable electronic devices, such as smartphones, cellphones laptops, tablets, etc. The current growth in these applications, as well as the latent potential demand for more advanced versions, is driving the research into the next-generation of electrochemical energy storage cells. **Lithium continues to be a leading candidate as a key material for the next-generation of rechargeable batteries** due to the metal's unique attributes of high energy density, high voltage (~3.6 V nominal), no memory effects and relatively low self-discharge.

The burgeoning growth of devices and systems dependent on electrical storage devices demands the development of **the next generation of batteries**. The advancement of these devices and systems is being hindered by significant limitations of current battery technology. First, **the need for longer life spans** and **more rapid recharging times** for high-performance consumer devices, such as smartphones, cell phones, digital cameras, wearables, etc. Second, the requirement for **greater energy capacity** in certain battery applications, such as electric vehicles, wind turbines, solar farms and power grids. In addition, wind power and photovoltaic power sources also have special requirements to cope with the fluctuation of power generation and the stabilization of the electrical power grid. Third, electric vehicles (EVs) require enhanced **capabilities for rapid discharge** in order to accelerate quickly and **for rapid recharge** to improve consumer convenience and acceptance.

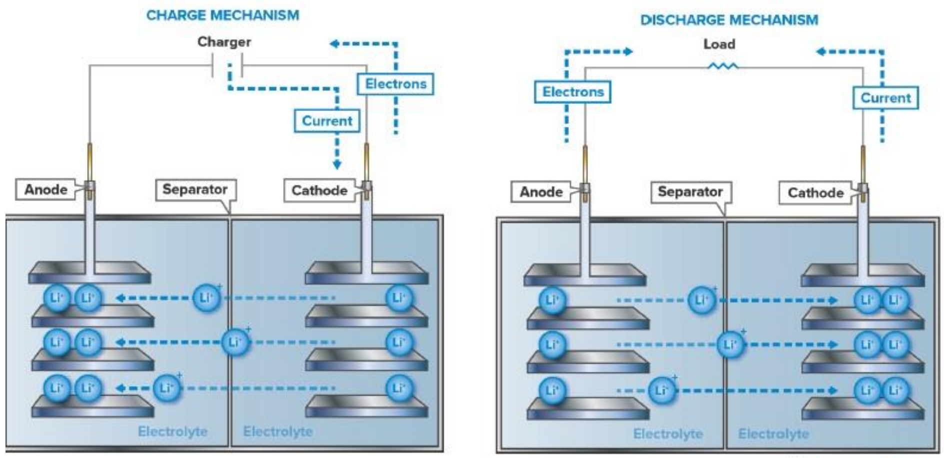
BRIEF LITHIUM BATTERY PRIMER

How a Lithium-ion Battery Works

Simplistically, batteries store energy chemically and convert this chemical energy into electricity through an electrochemical reaction inside the battery cell that causes ions to move between the **cathode** (positive electrode) and the **anode** (negative electrode). When being charged, ions (in the case of a lithium battery, lithium ions) move from the cathode to the anode through an **electrolyte**. A **separator** divides the positive and negative electrodes, but allows the ions to pass through. During discharge, the ions migrate back to the cathode releasing electrical energy.

Lithium-ion batteries have certain advantages over the previous generations of rechargeable batteries of nickel-cadmium (Ni-Cd) and nickel-metal hydride (Ni-MH) batteries, which were once prevalent. For example, the energy density (as measured in Watt-hours per 1 kilogram of battery) of an average lithium-ion battery (with a carbon/graphite anode) ranges from 150-200 Wh/kg versus 60-120 for a Ni-MH battery and only 45-80 for a Ni-Cd battery. The energy density of an average lead-acid battery in an automobile is in the 25-50 Watt-hour per kilogram range.

Diagrams of Lithium-ion Charge and Discharge Mechanisms



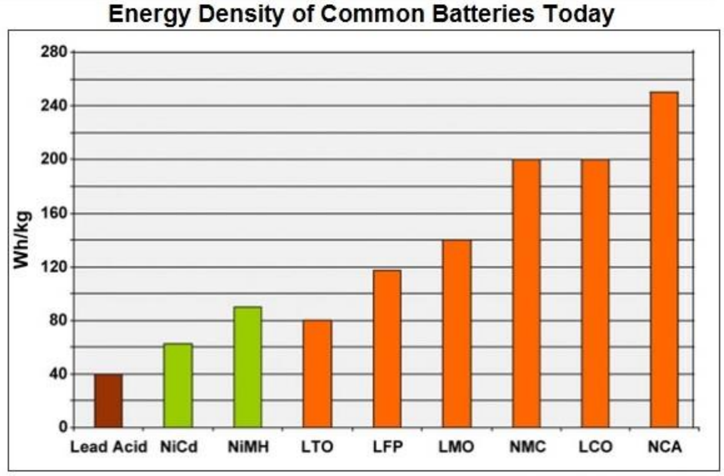
"How Lithium-ion Batteries Work" *Marshall Brain*

Though always evolving, **current lithium-ion battery technology** is based on the carbon-based (mostly graphite) anodes, lithium cobalt oxide cathodes and lithium salt electrolytes (a mixture of ethylene carbonate and dimethyl carbonate being the most common for non-aqueous batteries). However, the present commercial technology is deficient in energy density for powering the next generation of high-tech and heavy-duty applications in portable electronic equipment and electric vehicles, particularly in terms of long-term durability and energy density.

Current lithium-ion technology (generally used for mobile telephones, tablets, laptops and cameras) is based on a layered lithium cobalt oxide ($LiCoO_2$) cathode and a graphite anode. The major drawbacks of the lithium-cobalt battery are a relatively short life span (500-1,000 recharging cycles) and limited load capacity (150-200 Wh/kg). Furthermore, cobalt is a relatively scarce metal which would increase costs. Other types of lithium-ion batteries are prevalent that utilize a variety of other substances. Each has attributes that are better suited for certain other applications, which are listed below:

- Lithium Manganese Oxide ($LiMn_2O_4$) for power tools, medical devices & electric powertrains – energy density (100-150 Wh/kg) and with 300-700 recharging cycles
- Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_{2)}$ for E-bikes, medical devices & EVs – energy density (150-220 Wh/kg) and with 1,000-2,000 recharging cycles
- Lithium Iron Phosphate ($LiFePO_4$) for high load requirements – energy density (90-120 Wh/kg), 1,000-2,000 recharging cycles but can pulse discharge for high 40 amp load
- Lithium Nickel Cobalt Aluminum Oxide ($LiNiCoAlO_2$) for medical devices, electric powertrain (Tesla) – high energy density (200-260 Wh/kg) but only 500 recharging cycles
- Lithium Titanium Oxide ($Li_4Ti_5O_{12}$) for UPS, electric powertrain (Mitsubishi & Honda Fit), solar-powered street lighting – lower energy density (50-80 Wh/kg) but with 3,000-7,000 recharging cycles

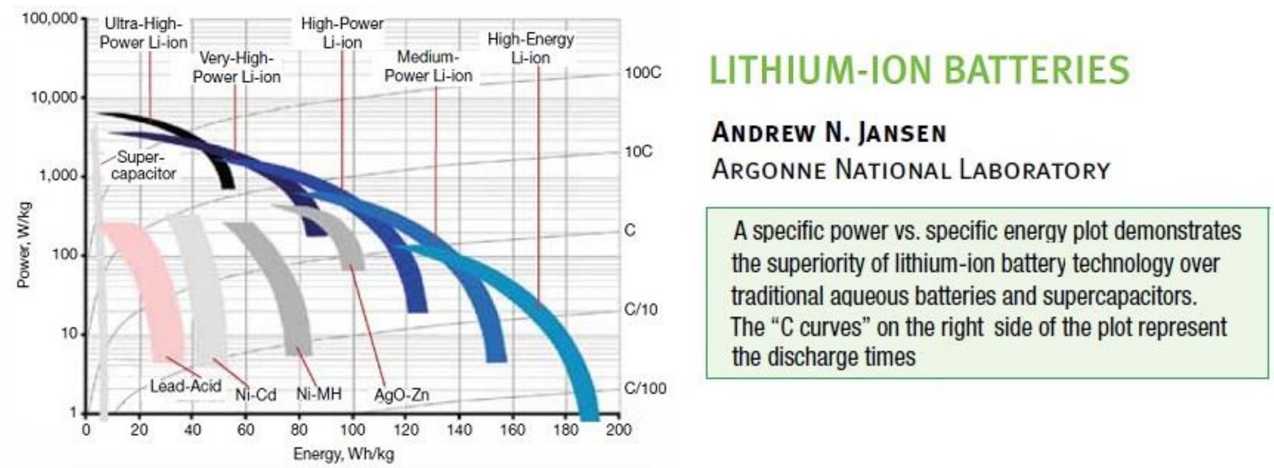
Energy Density of Common Batteries Today



Battery University Courtesy of Cadex

THE CHALLENGES OF PRODUCING THE NEXT GENERATION LITHIUM BATTERY

Lithium continues to be a leading candidate for the next-generation of electrochemical energy storage devices. Due to certain characteristics of lithium, lithium-ion batteries have longer total life span, hold a charge better, operate at higher voltages and can be manufactured in smaller and lighter packages.



Much research is being conducted to develop the **next generation lithium battery**, which will deliver improved performance in terms of higher energy density and longevity. These further advancements should lead to not only more widespread adoption of current portable electric-powered devices, but will also lead to new applications that will in turn drive additional dramatic increases in demand for lithium batteries.

The electrochemical performance of lithium batteries is determined by properties of the materials used for the anode, cathode, electrolyte and separator, along with the methods of engineering that incorporate these materials into the major components of the battery. The research extends into **new active materials for the anode, cathode, electrolyte** and **separator**. It should be noted that the successful next generation battery will be achieved not through an innovative new active material alone, but through also optimizing the mechanisms of interactions between the electrodes and the electrolyte system.

Simplistically, researchers are seeking substantial improvements for the next generation rechargeable battery, broadly in terms of performance and longevity, in other words, energy density, capacity fade (aka degradation), charge lifespan and overall battery life span (aka cycle life or cyclability or durability). In addition to performance and longevity, some other important considerations (including cost, size, weight, quality, safety and the speed of manufacturing process) are important in determining the ultimate commercial viability of the next generation decentralized electrochemical energy storage device.

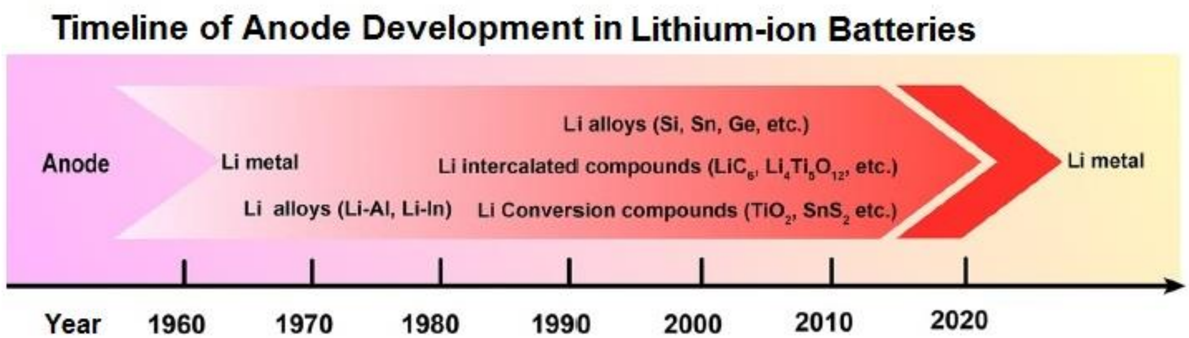
Research on Alternative Anode Materials

The **next-generation of batteries** seeks to improve upon several limiting attributes of current technology. At present, lithium-ion batteries are primarily electrode limited, particularly with the current anode material of graphite, which has limited storage capacity.

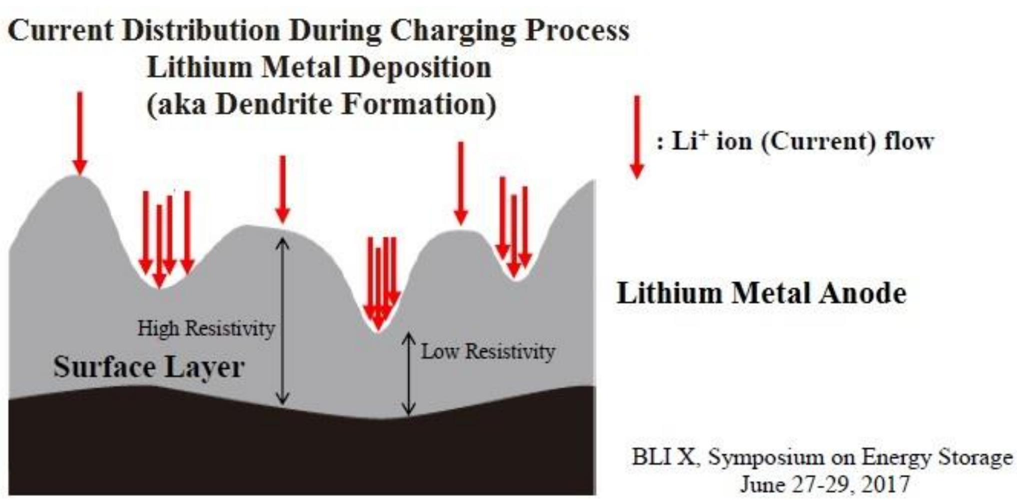
Metal oxides (such as SnO and SnO_2) have been considered as potential anode materials for lithium-ion batteries due to their higher energy capacities and potentially better safety characteristics. However, a significant irreversible reduction in energy capacity occurs during the first charging cycle since the first extraction of lithium causes a major structural change, namely the formation of amorphous Li_2O and Sn. This reaction has been a deterrent to a commercially feasible metal oxide anode battery.

Another proposed anode option is to utilize **silicon-based anodes**; however, this alternative incurs the technological obstacle of accelerating the aging mechanism. **The formation of SEI (secondary electrolyte interphase) layer**, which typically occurs on the anode during the recharging process, is normal in lithium-ion batteries. However, the use of a silicon-based anode results in the SEI layer thickening over the charging cycles, causing a substantial decrease in surface conductivity. As a result, the silicon-anode battery's coulombic efficiency (which is defined as discharge capacity/charge capacity) declines. Therefore, it is unlikely that silicon-based anodes will succeed as a viable alternative.

Also, during the charging cycle, silicon-based electrodes experience excessive volume expansion and contraction, which causes irreversible electrode deformation and fracture. This mechanical degradation of the silicon anode leads to pulverization and fracture of the electrode, which results in the reduction of energy capacity. Some other lithium-metal alloys also are susceptible to this unacceptable mechanical degradation of volume expansion and contraction.



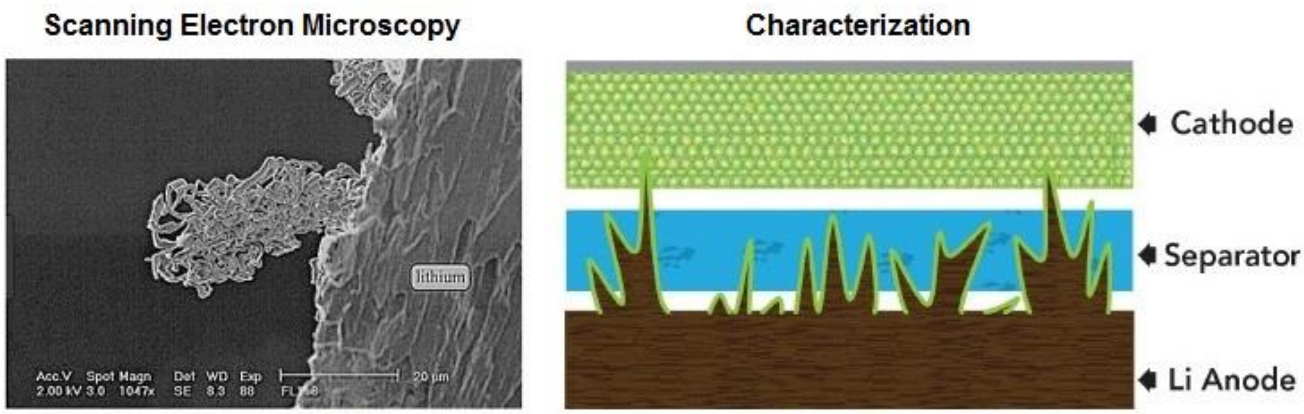
A very attractive and promising pathway to **increased power** is the use of a **lithium metal anode**, which theoretically has a coulometric capacity that is roughly 10 times greater than that of the current graphite anode in use in lithium-ion batteries today (3,860 mAh/g versus 370 mAh/g).[iii] Therefore, the most interesting advanced anode material for the development of the next generation of lithium batteries is **lithium metal**, which would significantly increase a battery cell's energy density while at the same time experiencing a reduction in weight, an exciting prospect for next generation rechargeable batteries.



However, **a significant challenge** to the utilization of lithium anodes in the next-generation battery is the plating behavior of lithium, due to **the formation of dendrites** during cycling. The dendrite is some small quantity of lithium metal that forms on the anode in a branching, treelike structure over charge and discharge cycles. Though some dendrites form during cycling and pose no major impediment, other dendrites become "dead lithium", which no longer participates in the electrochemical cycling process. Such dendrites reduce conductivity, create an uneven plating surface and ultimately, cause significant reductions in the capacity. Why these dendrites form, and their precise composition is a matter for debate in industry and academia. One explanation is that during the charging phase when lithium ions migrate to the anode from the cathode, the ions tend to accumulate and deposit in certain spots due to the non-uniform current distribution on the anode owing to an unstable interface between lithium metal anode and the electrolyte system. As a result, undesired and uncontrollable lithium metal growths (dendrites) are created, more particularly where there is a lack of homogeneity on the anode's surface. Also, though beyond the scope of this report, the challenge is significantly more complex since there are several morphologies of dendrites depending on cycling conditions, namely needle-like, mossy-like and fractal-like.[iv]

Dendrite growth can cause failure, and even combustion, of a lithium ion or lithium metal anode batteries and is the cause of the fires in electric vehicles and personal electronic devices detailed in many recent dramatic press releases. As the dendrites grow from the surface and approach the cathode, the battery generates heat and, on occasion, short-circuits and bursts into flames, especially after the dendrites pierce the separator and absolutely when the dendrite reached the cathode. This **major limitation** overtime denigrates the battery's power capacity, compromises the battery's integrity and terminates the battery's usefulness, potentially causing catastrophic failures, including combustion through overheating (aka thermal runaway). A secondary obstacle is that freshly deposited lithium dendrites react with the electrolyte resulting in lower efficiencies of the electrodes and reduced cycle life.

Renditions of Lithium Metal Dendrites



Orsini et al 1998

SLAC National Accelerator Laboratory

The development of the next generation of lithium anode batteries is focused on dealing with this technological Achilles' heel either by **inhibiting/suppressing the formation of dendrites**. Many R&D groups in industry and academia are concerned with monitoring the extent of dendrite growth and understanding the mechanism of formation, composition and morphology of dendrites. This growing body of knowledge will serve in the goal of dendrite suppression/elimination. Several solutions are being proffered to deal with the build-up of dendrites. Research is being conducted on a variety of techniques to suppress the formation and/or monitor the growth of dendrites. Activities include:

- measure the electrical resistance between the cathode and the separator to determine the extent of dendrite growth
  - This option would terminate the life of the battery cell when a particular level of electrical resistance is reached; therefore, this potential solution produces a battery with a short life span as it does not address challenge of eliminating the formation of dendrites
- introduce a porous layer of material around the anode to deter dendrite growth
- utilize a solid electrolyte to deter dendrite growth
  - The majority of these types of electrolytes exhibit very poor ionic conductivity which results in a battery that exhibits poor performance in terms of charging efficiency and discharge capacity.
- stabilize the lithium anode with an alloy

- o Investigations into lithium metal anodes alloyed with tin (Sn), cobalt (Co) and carbon (C) demonstrate initial favorable cycling characteristics, but exhibit diminished capacity retention (lower energy density) after extended cycling
- o In addition, lithium-rich alloys generally undergo phase changes during charging (intercalation) and discharging (de-intercalation). The volume expansion and contraction results in cracking/crumbling of the anode material, degrading the anode's performance

- Deposit an ultrathin surface coating on the lithium anode as a protective layer to improve the homogeneity of the anode's surface in order to suppress the formation of dendrites
  - o Though a surface coating dramatically improves some metrics of the lithium anode's electrode performance, cycle life remains significantly lower than that of graphite
- utilize a very high purity lithium metal anode to theoretically create an anode surface environment hostile to the formation of dendrites

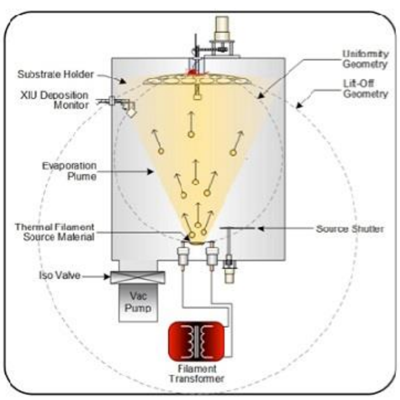
Advances That May Allow the Use of a Lithium Anode

Many studies have been conducted in order to create a viable lithium anode battery with improved energy density and high performance chargeability. The developments can be placed in a few categories:
- the physical construction of the lithium anode
- the surface condition and internal structure of the anode material
- the purification level of the anode material, which should also allow full utilization of the active material

<u>Physical Construction of a Lithium Anode</u>

The process of coating the anode's substrate with a lithium metal has challenged researchers. Two constructs that are being put forward for the manufacture of a lithium metal anode are <u>thin film</u> deposition and a coating with <u>cold rolled</u> lithium metal.

Thin film deposition refers to a group of technologies referred to as physical vapor deposition. These are vacuum depositing techniques for which the vapor source is a liquid or solid. Physical vapor deposition is optimal for thin films in the nanometer range i.e. from Angstroms (10^{-10} m) to microns (10^{-6} m). Deposition rates are often given in nanometers/minute. There are several thin film deposition methods, including sputtering, electron beam, laser ablation, electroplating and thermal evaporation.



Lithium Thin Film Thermal Evaporation System

One of the most common methods for depositing a thin lithium metal film as an anode is thermal evaporation. The process involves heating metallic lithium inside a high vacuum chamber until a vapor cloud forms. As the vapor comes in contact with the cold substrate, it forms a thin film. The system's design allows for methods to adjust a number of parameters including thickness, uniformity, grain structure, etc. The thermal evaporation deposition system is typically integrated so that immediately after the thin film of lithium metal is deposited, the energy storage device can be fully encapsulate before being exposure to the atmosphere. In is critical that metallic lithium is deposited and encapsulated in a vacuum state, since lithium easily oxidizes when exposed to air. Lithium metal has been deposited onto many different substrates from polymeric films to copper foils, generally in layers from 2 to 40 microns (*µ*) thick.[v]

Lithium anodes can also be produced with **extruded lithium metal**. The extrusion process involves forming a thin foil of lithium metal from an ingot through a procedure of cold extrusion until the desired shape and thickness is attained. The thickness of anode material is generally between 5 to 125 microns (*µ*)[vi] since these types of battery cells utilize solid electrolytes, which have low conductivity relative to a liquid electrolyte, and therefore require a high degree of contact surface.

Since lithium is highly reactive (easily oxidized when exposed to air), the process must be performed in a vacuum. Afterwards, the lithium foil is pressed onto the surface of the current collector with a hydraulic press using a special die fabricated so as to not chemically react with the lithium metal.[vii]

Lithium Extrusion Press

However, the extrusion process can cause mechanical instability and other problems for lithium metal to be used as anode material. First, extruded lithium foil often lacks the desired uniformity in thickness. Second, the morphology is conducive to the formation of dendrites. Third, lithium metal anode film should have an even thickness in the 40 to 400 *u*m range, but preferably in the 80 to 200 *u*m range; however, extruded lithium film is best produced only in the 250 to 400 *u*m range. Thinner lithium film can be extruded, but the lithium material then becomes prone to structural deformation, mechanical instability and fracture as the pressure of the extrusion process is exerted. The next generation batteries will likely require thin film anodes in the 5 to 50 *u*m range. Finally, the purity of the completed lithium foil can be compromised if exposed to ambient air. Great care must be taken not only to maintain a vacuum during the extrusion process, but also when loading subsequent lithium ingots (often a cylindrical roll of lithium weighing about 11 pounds), since ambient air will contaminate the walls of the cylindrical loading chamber.

Surface Condition - Nano Technology

The characterization of the anode's microstructure affects a battery's durability. Rough morphology or large particle size (over 0.6 *µ*m) on the anode surface are conducive to certain fundamental fracture mechanisms, particularly crack initiation by lithium invasion over repeated charging cycles. A reduction in the particle size better activates the electrochemical properties of the anode, which results in improved functionalization.

A well-defined, uniform nanostructure of the lithium metal anode helps provide a uniform current distribution to lithium metal surface and allows for more rapid ionic diffusion through the structure, which results in faster charging times and therefore, improved performance. In addition, nanostructured materials tend to undergo reduced modifications in volume during the electrochemical process due to higher structural stability during volume expansions and contractions.

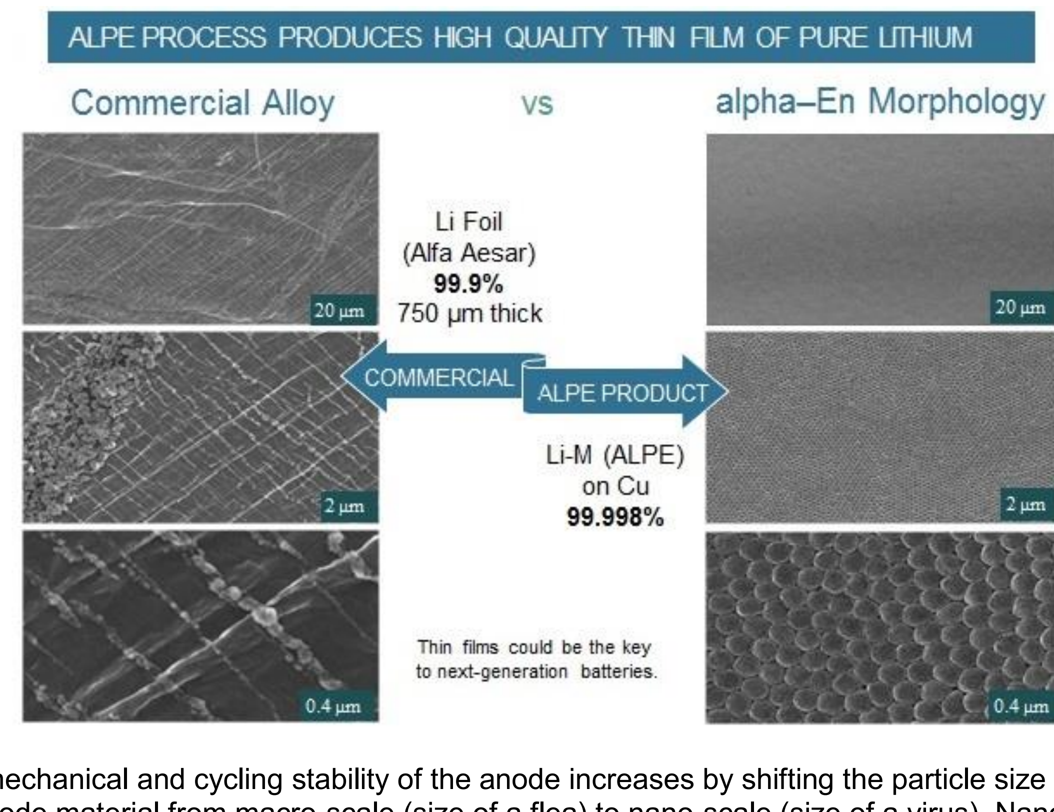
THE BREAK-THROUGH ATTRIBUTES OF ALPHA-EN'S LITHIUM ANODE PROCESS

alpha-En's Electro-Deposition Method for Lithium Metal Anodes

alpha-En plans to utilize an electrolytic deposition process for the production of high-purity lithium metal to create a **thin-film** layer of **high-purity lithium** onto a copper substrate. The process also allows for the control of various parameters that can yield uniform, densely-packed, high-purity lithium metal **nanorods**. The combination of the high purity of the lithium metal and the uniformity of the lithium morphology is anticipated to both **inhibit the formation of dendrites** and **improve the battery's performance**.

alpha-En's electrolytic deposition process yields a **layer of extremely pure lithium metal** onto a myriad of different conductive substrates. The technology involves an electrochemical process that sources lithium metal from an aqueous lithium source (lithium carbonate or other lithium salts) through a selective permeable (yet lithium-ion conducting) barrier and film. The deposited lithium layer is without nonconductive impurities and with a dramatically reduced presence of trace metals/undesired substances (up to 99.997% pure lithium metal in laboratory tests). Purity of lithium anode material is expected to be a key element to the successful development of a lithium anode battery.

alpha-En's electrolytic process permits the regulation of certain parameters, which allows for the precise control of lithium morphology for the **formation of a well-defined, densely-packed and uniform nanostructure** of dendrite-free lithium metal nanorods. An ordered nanostructure of the lithium metal anode is expected to improve battery performance. As an aside, nano technology refers to manipulating matter at a size ranging from 1 to 100 nanometers (10^{-9} to 10^{-7} meters).



First, the mechanical and cycling stability of the anode increases by shifting the particle size of the metallic anode material from macro-scale (size of a flea) to nano-scale (size of a virus). Nano-scale structures almost always advance the performance of an energy system. Second, the geometry of nanostructured lithium creates bright domains of ion-conducting pathways, **enhancing the electrochemical process**, thus supporting ultra-rapid charging and discharging and **improving cycling characteristics**. And third, the homogeneous and uniform surface of the lithium anode is expected to

suppress the formation of dendrites. All these benefits are in addition to the **leap in energy density** from utilizing a lithium metal anode.

alpha-En is putting forward a new construct with an electrolytic process that optimizes the relationship between electrochemical properties and the structure. Not only the does the **extreme pure lithium metal**, but also the **uniform deposition of lithium metal** enhance the electrochemical processes and suppress the formation of dendrites.

alpha-En continues to develop and aims to commercialize components in the next-generation of high-energy density lithium batteries that will improve battery performance in a numerous ways, from increasing the life of batteries in consumer devices (by increasing the number of charging cycles) to increasing the range of electric automobiles (by increasing energy density).

RECENT NEWS

Effective June 14, 2018, alpha-En purchased the minority 9.05% equity interest outstanding of Clean Lithium Corporation for 3,018,190 shares of ALPE. Now, Clean Lithium Corporation is a wholly-owned subsidiary of alpha-En Corp.

On July 9, 2018, alpha-En announced that the company and Cornell University have entered into a Cooperative Agreement to conduct sponsored research on alpha-En's patent-pending **lithium thin film production process**. The research is to be conducted at the Baker Laboratory by the Abruña Group under the direction of Professor Héctor D. Abruña. The group is anticipated to provide insights into the characteristics of alpha-En's thin film lithium metal deposition process, especially in terms of **quantifying capacity**. The Abruña Group also has the unique capabilities and tools to study **the ion transport process** on a microscopic scale in real time (*in operando*) during the time period of thin film growth. A successful demonstration of alpha-En's unique thin film lithium metal deposition process would be most useful for battery manufacturers to consider in their development of the next generation of rechargeable battery with a lithium metal anode.

RECENT FINANCINGS

Thus far, alpha-En has been successful raising capital to continue advancing the company's development of Lithium technologies. The company burns cash at a rate of approximately $450,000 per quarter.

Effective June 14, 2018, alpha-En closed a **$1 million equity financing** for 826,446 shares (priced at $1.21 per share) with a strategic investor who received a non-exclusive mandate to represent alpha-En's unique and proprietary technology for the extraction of highly pure lithium in China (PRC) for a period of two years. The net proceeds, which were actually received in April 2018, are earmarked for the purpose of funding research and development.

On February 8, 2018, alpha-En closed a private placement of **1,950 shares of Series A Convertible Preferred stock** and 975,000 5-year warrants (exercise price of $2.00) with several accredited and institutional investors, including CEO Sam Pitroda through Pitroda Group LLC, for gross proceeds of $1,950,000. **Net proceeds were $1.7 million** as three members of the management team (Steven Payne, Jerome Feldman and Jim Kilman) converted a total of 250,000 in advances to the company into shares of Series A Convertible Preferred stock. Sam Pitroda's investment visibly demonstrates his conviction in alpha-En.

On May 17, 2017, alpha-En completed a private placement of 1,820 shares **of convertible Series A Preferred stock and 910,000 warrants** with several accredited and institutional investors. **Net proceeds were $1.67 million**.

Series A Convertible Preferred stock accrues cumulative dividends at a rate of 10.0% (ultimately payable in cash or in additional shares of Series A Preferred stock). Each share of Series A Preferred stock (original issue price of $1,000) is convertible into 572 shares of ALPE common stock. Also, one year after issuance, shares of Series A Preferred stock are redeemable at the original issue price plus any accrued dividends.

During 2016, the company **raised approximately $1.4 million** in capital through private placement offerings of approximately 1.5 million shares of common stock and 5-year warrants entitling the holder to purchase approximately 1.4 million shares of common stock at a weighted-average exercise price of $1.68.

VALUATION

Valuation analysis of companies that are advancing new disruptive technologies is a very challenging exercise, especially when they are pre-revenue entities in the development stage.

The leap in performance of rechargeable batteries by successfully utilizing a lithium metal anode would have broad impact with significant economic consequences. The next-generation battery would become even more ubiquitous than today since the advancement would further transform life, business and the global economy. The profound impact would rival those of the development of synthetic rubber, the transistor, the integrated circuit, the microprocessor, the PC and its operating system, which enhanced the fortunes of Bayer, AT&T (Bell Labs), Texas Instruments, Intel, IBM and Microsoft, respectively. The developer of the next-generation battery technology (or any proprietary owner of a component of its core technology, such as alpha-En), would garner significant market share in multiple fast-growing industries, including electric vehicles, personal electronic devices and power grid storage batteries.

Past Disruptive Comparables	**% Chg YTD**	**P/E CFY**	**EPS Gr 5Yr Est**	**Price/ Book**	**Price/ Sales**	**Price/ CF**
ALPHA-EN CORP	-34.7	N/M	N/M	N/M	N/M	N/M
Industry Mean	4.4	16.0	7.5	6.5	4.3	12.7
Industry Median	10.1	12.9	8.4	7.2	3.8	9.8
S&P 500	4.8	18.1	10.8	12.7	4.5	19.8
AT&T INC	-20.0	9.0	3.4	1.3	1.2	4.4
INT'L BUSINESS MACHINES	-4.6	10.6	4.9	7.2	1.7	7.8
INTEL CORP	12.5	12.9	8.4	3.5	3.8	9.8
MICROSOFT CORP	24.2	26.0	11.2	9.9	7.4	20.2
TEXAS INSTRUMENTS	10.1	21.4	9.5	10.6	7.3	21.5

A reasonable methodology is a scenario approach that models a plausible value of sales for a disruptive technology at some point in the future, and then applies an expected valuation multiple on an relevant metric, while accounting for any potential dilution anticipated during the development stage and, of course, the probability of successfully bringing the technology to market. Then by utilizing a net present value (NPV) calculation, one determines a price target for the current year.

According to BIS Research, the market for EV batteries is estimated to grow at a 20% CAGR between 2016 and 2026 and reach $93.94 billion[viii], which implies a $78.3 billion market in 2025. Bloomberg forecasts that sales of EVs will increase from 1.1 million worldwide in 2017, to 11 million vehicles in 2025. These estimates may prove conservative given that the next generation of battery will have a significantly higher energy density so that the adoption of EVs may accelerate more than currently expected as the vehicle range per charge extends to over 500 km. However, dovetailing these publically-available, conventional projections, the estimated battery content value per vehicle in 2025 will be roughly $8,000. In addition, accepting the assumed profit margin of 35.6%, the cost of goods sold is estimated to be $5,175 per vehicle, of which, according to MOBI Research, 15% is anticipated to constitute the cost of the active anode material. [ix] Therefore, $569 is expected to accrue toward the value of alpha-En's anode IP.

We expect alpha-En to pursue the licensing of its intellectual property, but management has not issued any guidance on the terms of any potential licensing/royalty agreement between alpha-En and its developmental partners. However, we must make an assumption for valuation purposes. Given the bargaining power of the partners, the company's royalty will be less than 50%. Taking into account that the next generation of batteries will be used alongside the current state-of-the-art battery chemistries and other potentially promising future battery technologies, we are conservatively estimating that a next generation battery utilizing alpha-En's technology would gain 40% market share. Incorporating all these factors, we estimate that $153 million could be generated in royalties/licensing fees by alpha-En by the EV industry. However, given the nascent state of the company's developmental efforts, we assign a 20% probability of success, which converts to $30.7 million in revenues for valuation purposes. It is recognized that the critical assumptions concerning these probabilities of this scenario are highly subjective.

In the case of a successful transition to lithium metal anode batteries, the new technology would supplant the great majority of applications for rechargeable lithium-ion batteries. This next generation of batteries would also garner market share in energy storage systems on the power grid and in personal electronic devices, such as smartphones, tablets, wearable, etc. Utilizing projected global market shares for the automobile, consumer and energy storage segments that are available from Frost & Sullivan, we estimate that for valuation purposes the energy storage systems would contribute $38.5 million in revenues, and the consumer space would add $24.5 million for a total of $93.7 million from all three segments.

We assume that the current 8.474 million outstanding options and 5.719 million warrants would be exercised, in addition to the conversion of Series A preferred into common shares, since the exercise prices are below our target price. Future rounds of capital funding are also expected to create dilution. We currently anticipate that 940,000 additional shares will be issued through 2025 to help fund the company's efforts to bring its technologies to market.

It should be added that the achievement of certain milestones would de-risk alpha-En's prospects. For example, an announcement that one of alpha-En's partners would be pursuing of a go-to-market plan utilizing alpha-En's lithium metal technology, in our opinion, would increase the probability of success to 35%.

Due to the complexity of estimating the potential margins and profitability of alpha-En, an alternative valuation methodology that utilizes the Price-to-Sales (P/S) metric is often applicable. The average price-to-sales valuation of current established companies which in the past have developed successful disruptive technologies (AT&T, Intel, IBM, Microsoft and Texas Instruments) are trading at relatively low P/S ratios, in the 1.2 to 7.3 range with a mean valuation of 4.3 times sales.

Generally, the valuations of start-up and high-growth companies are typically very much higher when compared with those of companies with mature businesses. However, there are contra-examples, such as Tesla (TSLA). As a new entrant in the early phases of its life cycle, Tesla initially traded at a higher P/S multiple reflecting the company's potential. As Tesla ramped up sales to the $204 million level in 2011, its stock traded at 13.9 times sales. However, subsequently in 2013, when sales reached slightly over $2.0 billion, the P/S valuation of TSLA declined to 10.3. This counter-intuitive concept can manifest itself for a variety of reasons, including the perceived risk of survival from a shortage of capital or increased competition to the threat of technological obsolescence due to the evolution of new technologies.

In summary, our valuation approach for a company advancing a disruptive technology utilizes a scenario approach that estimates the size of the potential market, makes some critical assumptions concerning market penetration and other factors, adjusts for risk by applying a probability of success and then applies anticipated dilution from capital offerings and from the exercise of options and warrants to fund the company's developmental efforts.

Utilizing projected risk-adjusted annual revenues of $93.7 million in 2025 with the expectation that alpha-En's stock will trade at a P/S ratio of 4.3 at that time, the share price target would be $10.21 in 2025. However, to translate that value to a current target price, we employ a net present value (NPV) calculation that utilizes a 15.5% discount rate to reflect the risks associated with this development project.

Therefore, our risked-adjusted valuation target of alpha-En for 2018 is $3.70 with upside potential of up to $6.50 if one of alpha-En's partners announces a go-to-market plan utilizing alpha-En's lithium metal technology.

RISKS

- Alpha-En has a limited operating history (about 10 years) and has not yet generated any revenues. As a result, the company has an accumulated deficit of $20.9 million as of March 31, 2018. Alpha-En is only in an initial commercialization stage with its lithium technologies, which have yet to be proven on a large-scale commercial basis. Until the company achieves profitability, additional capital will be needed to fund operations. Thus far, management has been successful in obtaining capital through both common and preferred equity offerings.
- As with all technology development companies, a product or process in development may not become commercially feasible. For example, in early 2009, Alpha-En acquired an exclusive, worldwide license for the processing of lithium metal in exchange for 1,000,000 shares of stock. After several years of testing, both at the lab bench and a production environment, certain inconsistencies with the process could not be solved, and the R&D efforts using this license were abandoned in 2013. As a result, the company became delinquent in its filing requirements, belatedly filing financial statements for 2012 on September 11, 2015, for 2013 on February 22, 2016 and for 2014 in the same filing for 2015 on October 20, 2016. However, since 2015 when the company began pursuing its current technology portfolio, alpha-En has met its filing requirements in a timely fashion.
- Since the company is still in the development stage, alpha-En burns cash at a rate of approximately $450,000 per quarter. Thus far, the company has been successful raising capital to continue advancing the company's development of lithium technologies.

BALANCE SHEET

alpha-En Corp.				
(in $ thousands)	**2015**	**2016**	**2017**	**1Q 2018**
Period ending	**12/31/2015**	**12/31/2016**	**12/31/2017**	**3/31/2018**
ASSETS				
Cash and cash equivalents	730	442	562	876
Prepaid expenses	301	91	0	500
Restricted cash	0	100	15	15
Restricted cash	61	0	0	0
Total Current Assets	**1,092**	**633**	**577**	**1,391**
Long-term deposit	0	50	35	35
Property and equipment	2	541	501	482
TOTAL ASSETS	**1,094**	**1,224**	**1,113**	**1,908**
Liabilities and Stockholders' Equity				
Accounts payable and accrued expenses	341	964	1,103	960
Advances from related parties	62	78	308	36
Total Current Liabilities	**403**	**1,042**	**1,411**	**996**
TOTAL LIABILITIES	**403**	**1,042**	**1,411**	**996**
Series A Preferred stock	**0**	**0**	**1,935**	**3,962**
Capital stock	322	333	334	334
Additional paid-in capital	10,705	13,987	18,482	18,326
Treasury stock	(69)	(69)	(69)	(69)
Accumulated deficit	(10,169)	(13,749)	(20,276)	(20,908)
Stockholders' equity (deficit) attr. to ALPE holders	**789**	**502**	**(1,529)**	**(2,317)**
Non-controlling interest	(98)	(320)	(704)	(733)
Total Stockholders' Equity	**691**	**182**	**(2,233)**	**(3,050)**
TOTAL LIABILITIES & STOCKHOLDERS' EQUITY	**1,094**	**1,224**	**1,113**	**1,908**
Shares outstanding	32,235,525	32,567,339	32,635,756	32,645,756

PROJECTED INCOME STATEMENT

alpha-En Corp.

Income Statement (in $ thousands, except share and per share data)	2015 12/31/2015	2016 12/31/2016	2017 12/31/2017	2018 E 12/31/2018
Revenues	**0**	**0**	**0**	**0**
Expenses				
General and administrative	1,040	1,666	4,367	3,025
Legal and professional fees	150	695	537	544
Research and development	651	1,436	1,927	1,171
Loss Before Other Income (Expenses)	**(1,841)**	**(3,797)**	**(6,831)**	**(4,740)**
Other income (expense):				
Interest income (expense)	-	-	2	0
Gain (loss) on extinguishment of acc'ts payable	-	-	(82)	0
Total other income (expense)	**0**	**0**	**(80)**	**0**
Net Loss	**(1,841)**	**(3,797)**	**(6,911)**	**(4,740)**
Net loss attributable to non-controlling interest	(49)	(217)	(384)	(29)
Net loss attributable to controlling interest	**(1,792)**	**(3,580)**	**(6,527)**	**(4,711)**
Dividends accrued on preferred stock	-	-	(115)	(308)
Deemed dividend on Series A preferred	-	-	(649)	(687)
Deemed dividend - beneficial conversion Pfd stock	-	-	(807)	(956)
Deemed dividend - issuance of common under anti-dilution prov.		(116)	0	0
Deemed dividend - inducement to exercise warrants		(378)	0	0
Net loss attributable to alpha-En shareholder	**(1,792)**	**(4,074)**	**(8,098)**	**(6,662)**
Basic and diluted loss per share	**(0.06)**	**(0.12)**	**(0.24)**	**(0.19)**
Wgted avg. shares - basic & diluted	30,849,087	33,347,318	33,312,970	34,183,992

alpha-En Corp.

Income Statement (in $ thousands, except share and per share data)	2017 12/31/2017	1Q 2018 3/31/2018	2Q E 2018 6/30/2018	3Q E 2018 9/30/2018	4Q E 2018 12/31/2018	Estimate 2018 12/31/2018
Revenues	**0**	**0**	**0**	**0**	**0**	**0**
Expenses						
General and administrative	4,367	794	744	744	744	3,025
Legal and professional fees	537	141	134	134	134	544
Research and development	1,927	(274)	482	482	482	1,171
Loss Before Other Income (Expenses)	**(6,831)**	**(661)**	**(1,360)**	**(1,360)**	**(1,360)**	**(4,740)**
Other income (expense):						
Interest income (expense)	2	0	0	0	0	0
Gain (loss) on extinguishment of acc'ts payable	(82)	0	0	0	0	0
Total other income (expense)	**(80)**	**0**	**0**	**0**	**0**	**0**
Net Loss	**(6,911)**	**(661)**	**(1,360)**	**(1,360)**	**(1,360)**	**(4,740)**
Net loss attributable to non-controlling interest	(384)	(29)	0	0	0	(29)
Net loss attributable to controlling interest	**(6,527)**	**(632)**	**(1,360)**	**(1,360)**	**(1,360)**	**(4,711)**
Dividends accrued on preferred stock	**(115)**	(77)	(77)	(77)	(77)	(308)
Deemed dividend on Series A preferred	(649)	(687)	0	0	0	(687)
Deemed dividend - beneficial conversion Pfd	(807)	(956)	0	0	0	(956)
Net loss attributable to alpha-En shareholders	**(4,074)**	**(2,352)**	**(1,437)**	**(1,437)**	**(1,437)**	**(6,662)**
Basic and diluted loss per share	**(0.12)**	**(0.07)**	**(0.04)**	**(0.04)**	**(0.04)**	**(0.19)**
Wgted avg. shares - basic & diluted	33,312,970	33,358,062	33,508,888	34,184,508	35,684,508	34,183,992

alpha-En Corp.

Income Statement (in $ thousands, except share and per share data)	2015 12/31/2015	1Q 2016 3/31/2016	2Q 2016 6/30/2016	3Q 2016 9/30/2016	4Q 2016 12/31/2016	2016 12/31/2016
Revenues	**0**	**0**	**0**	**0**	**0**	**0**
Expenses						
General and administrative	1,040	583	904	(89)	268	1,666
Legal and professional fees	150	49	196	221	229	695
Research and development	651	394	1,509	(381)	(86)	1,436
Loss Before Other Income (Expenses)	**(1,841)**	**(1,026)**	**(2,609)**	**249**	**(411)**	**(3,797)**
Net Loss	**(1,841)**	**(1,026)**	**(2,609)**	**249**	**(411)**	**(3,797)**
Net loss attributable to non-controlling interest	(49)	(61)	(174)	29	(11)	(217)
Net loss attributable to controlling interest	**(1,792)**	**(965)**	**(2,435)**	**220**	**(400)**	**(3,580)**
Deemed dividend - issuance of common under anti-dilution prov.			0	0	(116)	(116)
Deemed dividend - inducement to exercise warrants			0	(378)	0	(378)
Net loss attributable to alpha-En shareholder	**(1,792)**	**(965)**	**(2,435)**	**(158)**	**(516)**	**(4,074)**
					0	
Basic and diluted loss per share	**(0.06)**	**(0.03)**	**(0.07)**	**(0.00)**	**(0.02)**	**(0.12)**
Wgted avg. shares - basic & diluted	30,849,087	32,448,987	33,568,597	33,767,673	33,261,752	33,347,318

Income Statement (in $ thousands, except share and per share data)	2016 12/31/2016	1Q 2017 3/31/2017	2Q 2017 6/30/2017	3Q 2017 9/30/2017	4Q 2017 12/31/2017	2017 12/31/2017
Revenues	**0**	**0**	**0**	**0**	**0**	**0**
Expenses						
General and administrative	1,666	920	517	1,751	1,179	4,367
Legal and professional fees	695	170	85	135	147	537
Research and development	1,436	521	99	473	834	1,927
Loss Before Other Income (Expenses)	**(3,797)**	**(1,611)**	**(701)**	**(2,359)**	**(2,160)**	**(6,831)**
Other income (expense):						
Interest income (expense)	0	0	0	(82)	84	2
Gain (loss) on extinguishment of acc'ts payable	0	0	0	1	(83)	(82)
Total other income (expense)	**0**	**0**	**0**	**(81)**	**1**	**(80)**
Net Loss	**(3,797)**	**(1,611)**	**(701)**	**(2,440)**	**(2,159)**	**(6,911)**
Net loss attributable to non-controlling interest	(217)	(91)	(34)	(125)	(134)	(384)
Net loss attributable to controlling interest	**(3,580)**	**(1,520)**	**(667)**	**(2,315)**	**(2,025)**	**(6,527)**
Dividends accrued on preferred stock		0	(22)	(46)	(47)	(115)
Deemed dividend on Series A preferred		0	(649)	0	0	(649)
Deemed dividend - beneficial conversion Pfd stock		0	(807)	0	0	(807)
Net loss attributable to alpha-En shareholder	**(4,074)**	**(1,520)**	**(2,145)**	**(2,361)**	**(2,072)**	**(8,098)**
Basic and diluted loss per share	**(0.12)**	**(0.05)**	**(0.06)**	**(0.07)**	**(0.06)**	**(0.24)**
Wgted avg. shares - basic & diluted	33,347,318	33,282,089	33,282,089	33,337,722	33,300,633	33,312,970

HISTORICAL STOCK PRICE

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ADDITIONAL INFORMATION

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[i] Electrowinning is an electrochemical process whereby metals are extracted from a pregnant solution by passing a current from an inert anode through the solution resulting in the metal being deposited at the cathode.

[ii] Chlorine is designated an Extremely Hazardous Substance as defined in 40 CFR Part 355.

[iii] Takahisa Shodai, Amorphous V_2O_5 (-P_2O_5) and WO_2 as Insertion Anodes for Lithium Ion Batteries

[iv] Wood, Kevin N. et al, Lithium Metal Anodes: Toward an Improved Understanding of Coupled Morphological, Electrochemical, and Mechanical Behavior, ACS Energy Letters, February 16, 2017, p.666.

[v] R. Swisher et al, Progress in Vacuum Deposited Lithium Metal Anode Structures, 18th International Seminar & Exhibit on Primary and Secondary Batteries, March 5, 2001.

[vi] Laliberté, Richard, Patent - Process and apparatus for manufacturing lithium or lithium alloy thin sheets for electrochemical cells, United States Patent 7,194,884 B2, March 27, 2007.

[vii] Visco, Steven, Advanced Lithium Anodes for Li/Air and Li/Water Batteries, PolyPlus Battery Company, February 17, 2004

[viii] Global Electric Vehicles Battery Market: Focus on Battery Electric Vehicle, Plug-in Hybrid Electric Vehicle, Lithium-ion Battery, and Passenger Car Application - Analysis & Forecast 2017-2026

[ix] Berckmans, Gert, et al, Cost Projection of State of the Art Lithium-Ion Batteries for Electric Vehicles Up to 2030, MOBI Research Group, September 1, 2017, p. 13.