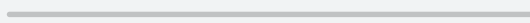




Lithium-Metal Technology Offers Cheaper, Higher-Density Closed Loop Batteries: SES CEO Qichao Hu

By Lynn Walford - April 26, 2022

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SES held a webinar to celebrate its tenth anniversary and educate viewers about lithium-metal (Li-Metal) battery technology. Industry experts, investors and CEO Dr Qichao Hu gave insights into how lithium-metal batteries could change the battery landscape. Hu also answered Auto Future’s questions in detail.

Researchers, engineers and investors congratulated SES for its accomplishments.

In 2021, SES raised Series D and D+ rounds led by General Motors and Hyundai. Then the company went public through a SPAC with Ivanhoe Capital Acquisition Corp. Investors also include Honda, Geely, Foxconn, Shanghai Auto, Koch, and affiliates of LG and SK. SES was listed on the New York Stock Exchange under the ticker symbol “SES” in February.

“In the past ten years, we built a solid foundation. We do not know for sure what the next ten years will hold for us. But we know we are at the cusp of a seismic change in the industry. We sincerely appreciate everyone’s support and trust. We will continue to innovate, deliver and evolve. The future will be greater than we can imagine,” says Hu.

SES was founded in 2012 as part of MIT Professor Donald Sadoway’s research group where Hu completed his doctorate post-doctoral research on Solid Polymer Ionic Liquid (SPIL) Li-Metal batteries. The company was incorporated as SolidEnergy Systems in April 2012.

“We dropped solid-state Li-Metal as our focus due to fundamental challenges in manufacturability and the discovery of novel high concentration solvent-in-salt electrolyte,” says Hu.

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In the fall of 2021, SES showed the world's first 100+ Ah Li-Metal battery cells.



What's the Next Milestone For Batteries?

"The novel anodes like silicon and the lithium-metal are becoming the front runners for the next generation batteries," says Dr Shirley Meng, Professor, University of Chicago.

She explains that lithium is the lightest metal on earth, making it the ultimate choice for the metal of an anode.

"Whether you use solid-state or not, it is not the key. The key here is the electrolyte. Lithium-metal anode leads to higher volumetric and gravimetric energy density. There are challenges finding a compatible electrolyte with high silicon anodes," explains Meng.

"I have to give kudos to the people who work on lithium-metal because they worked out how to find a good electrolyte for lithium-metal," she says.

"I did a due diligence report for SES. The high discharge and the high-power capability of lithium-metal was something we did not see in the silicon-metal anode. I think special performance metric improvements are coming from the lithium-metal anode besides the energy density numbers. All of us are super excited about lithium-metal batteries."

How Can Lithium Be Cheaper?

Pure Lithium is working on making lithium-metal anodes less expensive by using the cheapest form of lithium – lithium sulfate.

"If you look at the price of lithium carbonate, the price went up to \$50,000 a metric ton. That's only about 20% of the actual market. The rest of it is under long term contracts. That's not feasible if you want the price to go down. What you have to do is buy the cheapest salt possible – that's what comes out of the ground. It is lithium sulfate," says Emilie Bodoin, Founder and CEO of Pure Lithium.

Donald Sadoway is Pure Lithium's Co-founder and Chief Scientific Officer.

She explains Pure Lithium's process: "We take lithium sulfate or carbonate any salt but lithium sulfate is our preference mainly because of the costs and we electrodeposit it through a polymer membrane onto the

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copper. We control the thickness of the film by the amount of time the deposition is running and the current density.”



Long Lasting 0.25 Million-Mile Batteries

SES is not only working at battery chemistry but software and the whole life cycle of the batteries.

Li-Metal batteries will lower the cost and increase the performance of EVs. Also, Li-Metal will come with a 'Mine-to-Men' AI software that tracks data from the carbon footprint of mines, battery materials, vehicle data to recycling, Hu tells Auto Futures.

“The whole closed loop is important from departmental, economic and technical perspectives,” says Hu.

Li Metal batteries are expected to last a long time.

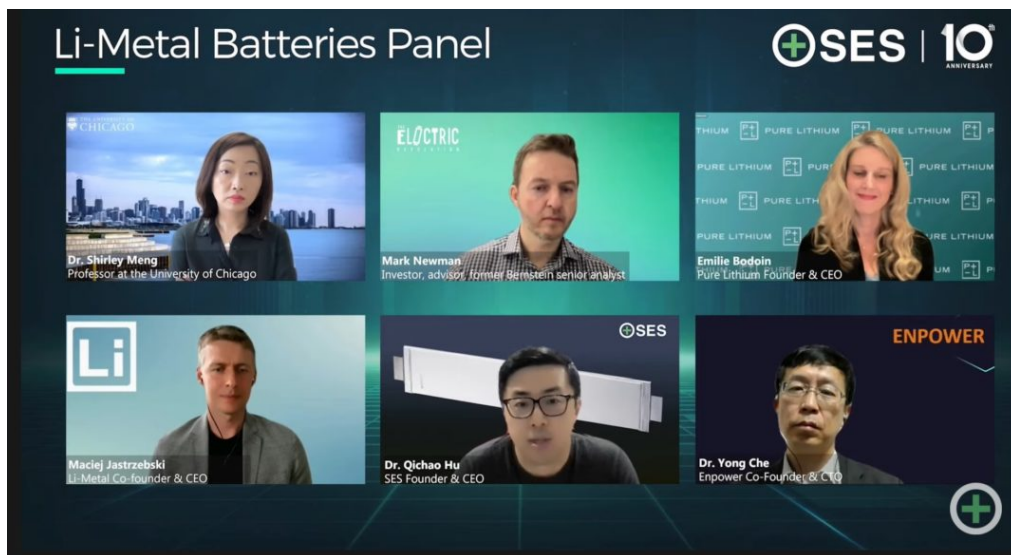
“On average, a Li-Metal powered vehicle can go 500 miles and last at least 500 cycles, so the total life is 250,000 miles. This will vary depending on the vehicle, but in general around 250,000 miles,” says Hu.



Are Lithium-Metal Batteries Commercially Viable?

Auto Futures caught up with the panel moderator, Mark Newman, who explained that the lithium-metal with liquid electrolyte approach is far more commercially viable than any solid-state alternative due to a proven manufacturing process because it is virtually identical to lithium-ion production.

“Some of the solid-state approaches, by comparison, use exotic chemistry and manufacturing techniques which only work at lab scale. The proof is in the 100 Ah cell that SES has already shown off at its Battery World event last year, versus tiny 2 Ah cells from solid-state competitors. This 100 Ah cell from SES has already demonstrated a whopping 417 Wh/kg energy density (vs. lithium-ion around 200-250 Wh/kg),” says Newman.



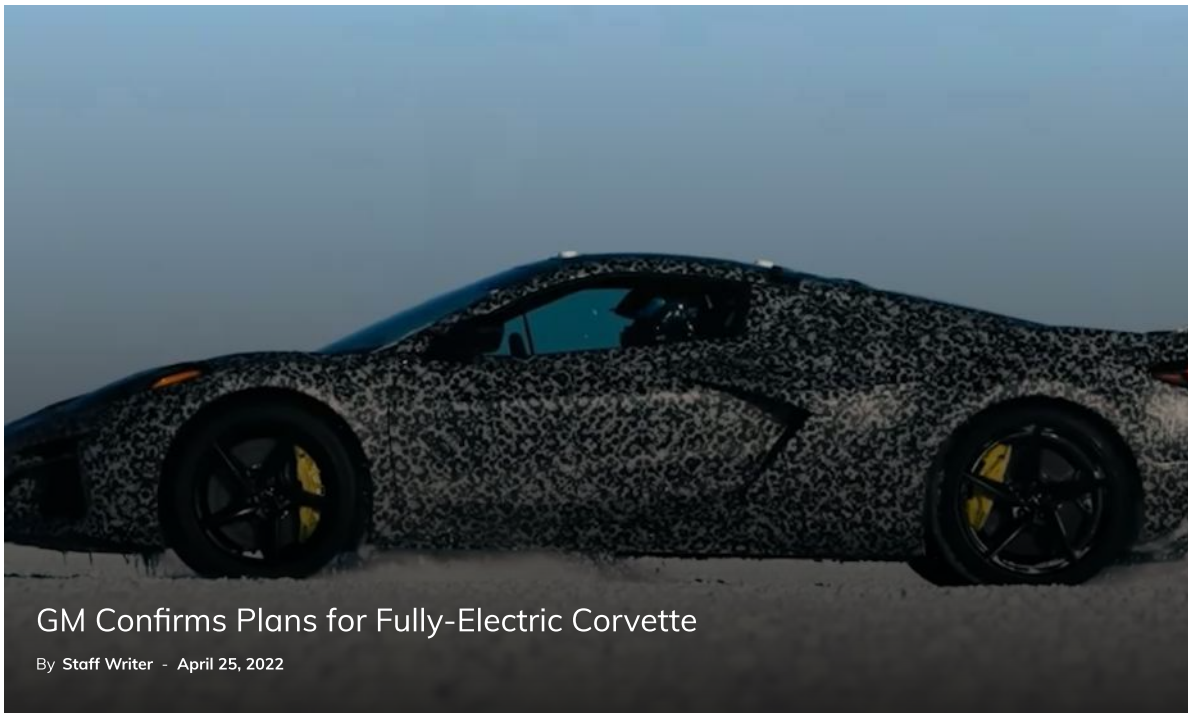
What is the Future of SES Li-Metal Batteries?

Hu says that the company expects to supply automakers A-sample cells that meet all technical specs this year. B-sample cells and modules are expected in 2023. SES is aiming for C-sample cells, modules, and vehicles in 2024 with commercial production starting in 2025.

Hu sees many more uses for Li-Metal batteries in the future. He says the batteries can be deployed in eVTOL, electric flying cars, drones, robots, delivery vehicles, warehouse management vehicles, fleet vehicles and boats.

Lynn Walford

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GM's Chevrolet brand has confirmed plans to make an electrified Corvette which will be available as early as next year, and a fully electric version will follow. On LinkedIn, Mark Reuss, President at General Motors, wrote: 'Some time ago we moved the Corvette team into the EV space in Warren, Michigan, and when we revealed the new mid-engine Corvette, I said there would be "more to come." This morning I sat down with Phil LeBeau of CNBC and finally answered the question I've been asked countless times'.

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