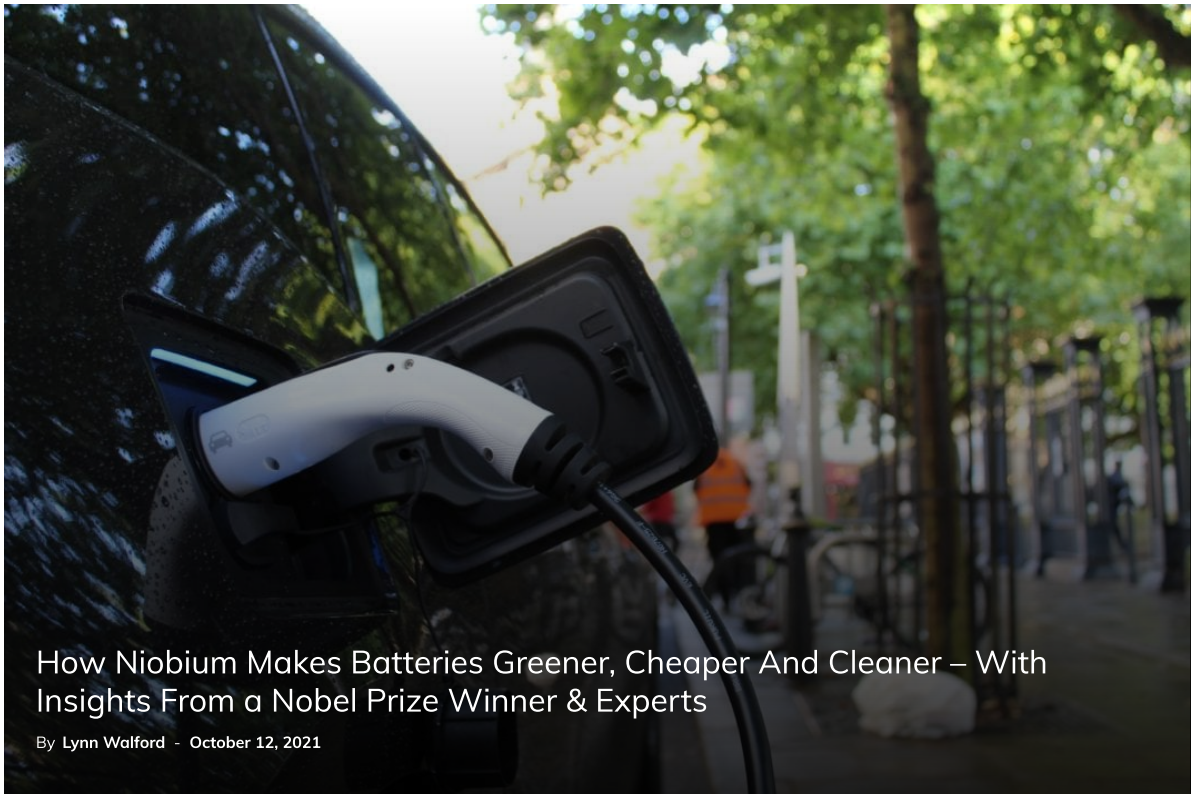


How Niobium Makes Batteries Greener, Cheaper And Cleaner – With Insights From a Nobel Prize Winner & Experts

By **Lynn Walford** - **October 12, 2021**

Reading Time: 4 minutes

CBMM Niobium hosted the 'Powering Future Electrification – Innovative Battery Materials' webinar on cathodes with visionaries in the industry reporting new findings. Niobium (Nb) is a soft metal formerly called Columbium in the U.S. CBMM is a supplier of niobium products and technology.

Researchers are discovering Niobium can be used in batteries for stability, increased capacity, coatings and faster charging.

Participating in the webinar were Nobel Prize in Chemistry winner Professor Stanley Whittingham, Dr Stephen Campbell, CTO, Nano One Materials Corporation, Mark Gresser, President and CEO, Wildcat Discovery Technologies and Professor Yang-Kook Sun, Hanyang University.

Nobel Prize Winner Hark Backs to Crystal Days

Professor Stanley Whittingham FRS, winner of the Nobel Prize in Chemistry in 2019, for his work with lithium-ion batteries talked about Niobium's properties, thousand-mile batteries, single-crystal cathodes and electric cars.

He reported that Niobium cleans surfaces and helps with capacity retention.

"Clearly, niobium is stabilizing materials. It is slightly reducing thermal evolution," says Whittingham, "As far as cycling, it helps to reduce cell impedance dramatically."

"Today, everyone uses meatballs. What's the other alternative? If we go back to our early days at Exxon, we used single crystals. When we say we are getting bad behaviour it is because the meatballs themselves are cracking," says Whittingham.

He notes that Jeff [Dahn] started with the concept of million-mile batteries. He explains why single crystals allow for million-mile batteries.

"The key to this [single crystals] is less surface area, less side reactions and longer life with million-mile batteries. It doesn't mean you are going to drive a million miles. What it means is that you will be able to have your vehicle plugged into the grid. It will help stabilize the grid. The utility will be able to take electricity out of your system and put it back in again," says Whittingham.

"You can stop single crystals themselves from cracking by keeping them about 3 microns in size. The next step is to incorporate Niobium into the single crystals and to see if that still further stabilizes them," he says.

In the future, he advises that the Niobium industry needs to work on new manufacturing technologies; new regional supply chains (as proposed in Europe); clean mining with clean energy and clean recycling technologies.

Auto Futures asked Whittingham, "Are electric vehicle batteries how you would like them to be for you to be driving an electric vehicle?"

"I don't drive an electric vehicle right now because I live up in the hills in the snow. I need a four-wheel-drive vehicle. However, I'm looking at the new BMW and the new Volkswagen SUVs. If someone can give me one, I'll be happy to try it out. In general, electric cars are not good at cold-starting," answers Whittingham about driving in Bingham, New York.

Brewing Cathode Materials in One Pot

Dr Stephen Campbell, CTO, Nano One Materials Corporation, offered insight into Nano One Materials' better way of making cathode materials in a single pot.

The patented One Pot process of making cathodes starts with all the materials in one reactor which he likens to a bucket with a stick. The process reduces waste, sulfates and firing time. It uses a fraction of the carbon footprint of other methods and can save thousands of dollars per ton, says Campbell.

The One Pot process can produce coated single-crystal structure in cathode active materials that improves durability. Niobium is the chosen coating element to form a thin Lithium Niobate ($LiNbO_3$) coating on each crystal, reports Campbell.

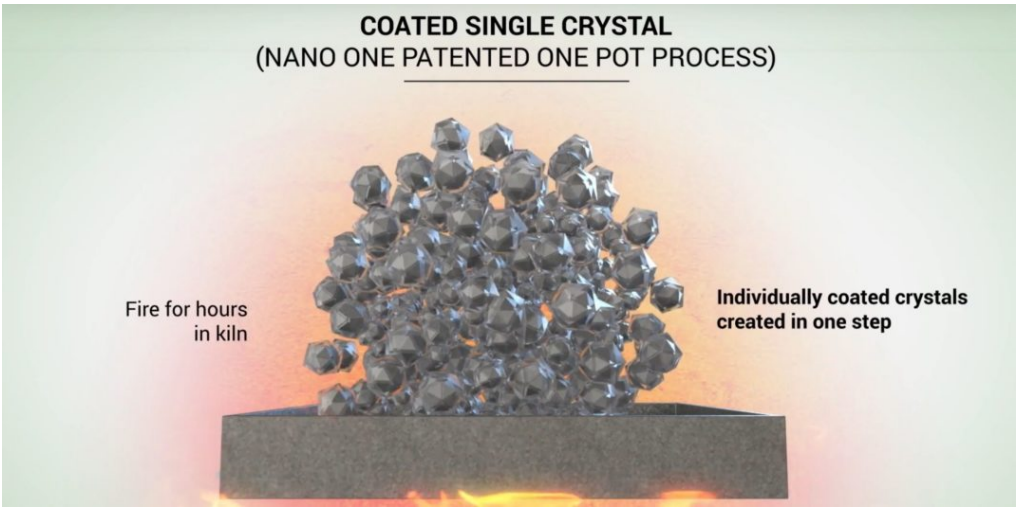
“The Lithium niobate coating sticks very well and coats every surface of the individual crystals,” says Campbell.

Individually coated nanocrystals resist fractures while boosting durability and performance reports Nano One Materials literature.

Lithium niobate can also be used in solid-state electrolytes for better performance and durability, says Campbell.

“We needed a way of adding Niobium into our one-pot in a soluble form which is not easy to get in industrial form. So, we partnered with CBMM to supply Niobium that works in the one-pot process,” says Campbell.

He concluded, “Niobium is an important element in high-performance lithium-ion batteries for the future of energy technology.”



Improving Battery Density with Disordered Rocksalts

Mark Gresser, President and CEO, Wildcat Discovery Technologies, showed the company’s latest research on Disordered Rocksalts (DRX) Cathodes using environmentally-friendly Niobium.

Lithium-ion is approaching the limit for traditional materials’ energy density. The cathode makes up 20-40% of the overall cost of batteries. Cobalt used in cathodes has high volatility in pricing, reports Gresser.

Wildcat discovered many benefits of DRX which include improved energy efficiency, longer driving range, smaller batteries and reduced costs. Cobalt and Nickel can be eliminated for a better environmental footprint. The material is safer, reduces thermal management, and has energy density improvement.

“DRX can deliver a cost savings of $1,400 on an automotive battery pack,” says Gresser.

“We increase the energy density and Niobium is a key element,” says Gresser, “We expect to make significant progress in keeping costs as low as possible.”

He says, DRX has the capacity to be the next green material when solid-state batteries come around. DRX has low volume expansion making it suitable for solid-state batteries.

Hanyang University Research

Professor Yang-Kook Sun, Hanyang University, South Korea reported about how new Niobium technologies both for the cathode of and anodes of batteries makes them more stable, charge faster and have a longer service life.

"Introducing Nb ions during the lithiation of NCA85 represents an effective solution that guarantees sufficient battery life, fast charging and safety without compromising battery capacity for next-generation electric vehicles," explains Sun.

Although Niobium in batteries may not be available this winter in an electric SUV for Professor Whittingham – the technology is getting closer to commercialization.

"We are close to full commercialization in the next years," says Robson Monteiro, Senior Market Development Specialist at CBMM, "We are working with our partners for the next steps."

Lynn Walford

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