

DEVELOPING NEXT GENERATION ELECTROLYTES FOR ENERGY STORAGE

Don DeRosa, Eonix



Don DeRosa, Eonix co-founder and CTO and member of Innovation Crossroads Cohort 2, has developed the first high throughput, semiautonomous system that significantly reduces the time and cost to develop next generation materials for lithium ion batteries and ultracapacitors.

DeRosa and his team leveraged this system to design a drop-in compatible electrolyte for ultracapacitors. This electrolyte improves the cost-performance ratio of ultracapacitors, which are energy storage devices similar to batteries but with the ability to charge and release power more quickly than batteries. Ultracapacitors could enable faster charging for electric vehicles and renewable energy storage.

Accomplishments

By leveraging the expertise at Oak Ridge National Laboratory (ORNL) through Innovation Crossroads, DeRosa was able to develop the world's first high throughput, semi-automated electrolyte screening process. This process enabled the design of the first electrolyte product, a high voltage ultracapacitor electrolyte, that's currently scaling for commercial launch and will enable the development of a portfolio of electrolyte products for batteries and ultracapacitors.

Drop-in compatible electrolytes for ultracapacitors and lithium-ion batteries are expected to significantly reduce the cost of energy storage systems that are currently produced today for electric vehicles and grid storage. DeRosa's ultracapacitor electrolyte can reduce the cost of high-power systems for hybrid buses by as much as 15%, while the non-flammable lithium-ion battery electrolyte in development can reduce the cost of grid storage installations by 20%. These cost reductions will ultimately enable greater adoption of green technologies and a significant reduction in emissions.

The Process

By pairing active and passive additives with high stability solvents, the Eonix electrolyte has the capability of significantly increasing the operational voltage window which reduces the cost and size of ultra-capacitor modules. The high voltage window results from the use of materials that have a greater chemical stability and site selective reactions (SSR) that strategically passivated reactive functional groups.

The electrolyte's chemical composition can be tailored to have a much lower resistance than current solutions. The smaller ion size enables not only an increase in energy

EONIX

COHORT 2

Milestones

- Developed the world's first high throughput, semi-automated electrolyte screening process
- Designed the first drop in compatible, a high voltage ultracapacitor electrolyte
- Scaled for commercial launch to enable the development of electrolyte products for batteries and ultracapacitors
- Named Forbes 30 Under 30 Energy 2020
- Funding raised: \$600,000

“Innovation Crossroads provides hard-tech entrepreneurs with unmatched resources, guidance, and expertise to successfully navigate the challenges of commercializing paradigm shifting technologies. The program makes development of seemingly impossible technologies possible.”

Don DeRosa, Co-Founder and CTO, Eonix

density, but a higher ionic conductivity which results in a dramatic reduction in electrical series resistance. With a smaller average ion size, the electrolyte is able to fill electrode pores that were previously unavailable. Additionally, this smaller ion size enables the formation of a thicker double layer that increases capacity.

The Challenge

Energy storage materials research currently progresses at a glacial pace because of the diversity of resources and expertise needed to identify, synthesize, and test novel chemistries for lithium-ion batteries and ultracapacitors. The task of developing next generation material products for this market through conventional approaches is especially daunting for startup companies with limited resources and personnel bandwidth.

“The limited access we had, prior to joining Innovation Crossroads, which included necessary equipment and expertise, significantly reduced our ability to identify and commercialize new materials to build a better battery,” DeRosa said.

The ORNL Advantage

ORNL’s Innovation Crossroads program provided DeRosa with access to energy storage expertise coupled with research tools that propelled the product development efforts towards commercialization.

“Insights provided by the experts at ORNL on the building of a novel suite of electrochemical diagnostic tools were instrumental to accelerating our product development,” DeRosa said. “These newly developed diagnostic tools coupled with the array of readily accessible characterization assets available at ORNL, from high precision gas chromatography to dynamic electrochemical impedance spectroscopy, enabled Eonix to easily

overcome research obstacles that would normally be insurmountable for early stage hard tech startups.”

Prior to joining Innovation Crossroads, DeRosa had several promising electrolyte candidates for ultracapacitors that needed to be further developed and evaluated in commercial prototypes with no immediate path to developing a revenue generating product.

“Today, we are in the process of scaling our first ultracapacitor electrolyte product to launch in late 2020 and are in the process of developing a non-flammable lithium-ion battery electrolyte product for the defense and grid storage markets,” he said.

Future Growth

Carbon emissions throughout the world have grown over the last three decades but performance limitations of environmentally friendly energy storage technologies led to a slow transition away from fossil fuels. DeRosa’s research in electrolytes was driven by his desire to develop a technology that would pave the way for a seamless transition to green energy.

“I was drawn to establish a company that designed electrolytes specifically due to their compatibility with current manufacturing techniques for lithium-ion batteries and ultracapacitors with the hope that we can rapidly commercialize our innovations to tackle the immediate challenges of climate change,” he said.

In the next ten years, he plans to have developed a suite of electrolytes that can be broadly adopted by consumers.

“We plan to leverage the insights we have gained at ORNL to develop electrolytes over the next decade that enable affordable electric vehicles, low cost grid storage, and a greener future,” DeRosa said.



About Innovation Crossroads

Innovation Crossroads is a fellowship program based at Oak Ridge National Laboratory that matches aspiring energy entrepreneurs with the experts, mentors, and networks in technology-related fields to take their world-changing ideas from R&D to the marketplace.

Through an annual call, up to seven entrepreneurs will be selected to transform their ideas into energy, advanced manufacturing, and integrated grid companies with financial support from the U.S. Department of Energy’s Advanced Manufacturing Office and the Tennessee Valley Authority. Innovators will receive a fellowship that includes a personal living stipend, benefits, and travel allowance for up to two years, plus substantial funding to use on collaborative research and development at ORNL.

Contact

innvcrossroads@ornl.gov
Innovationcrossroads.ornl.gov