Kingston battery research and development

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Canada is making significant strides towards the electrification of transportation and becoming a cleantech manufacturing hub. Canada announced that it will ban the sale of fuel-burning new cars and light-duty trucks from 2035 to reach net-zero emissions across the country by 2050.

Canada has been a leader in battery recycling over the past couple of years, with several companies building up recycling capacity to meet growing market demands. Kingston with its thriving sustainable outlook and ample R& D capabilities was the springboard for companies such as Cyclic Materials to commercialize their technologies.

Queen"s University has the largest mining department in Canada and among the largest in the world. In fact, Queen"s mining engineers account for some 33 percent of all Canadian mining and mineral processing engineers who have graduated from Canadian universities.

The Queen"s Centre for Energy and Power Electronics Research (ePOWER) brings together academic and industrial researchers to develop a broad range of applications and expertise, from power transmission to alternative energy, to power consumption to power application-specific integrated circuits.

KINGSTON, R.I. - May 27, 2020 - For nearly 20 years, Brett Lucht has researched numerous improvements to lithium-ion batteries, exploring ways to extend the batteries" calendar life and improve general performance.

Now Lucht, a professor of chemistry at the University of Rhode Island, is undertaking a three-year study to improve battery performance at low temperatures as part of a $480,000 sub-contract with Brookhaven National Laboratory. The research, funded through the U.S. Department of Energy"s Office of Energy Efficiency and Renewable Energy, will be important to battery manufacturers, the automotive industry and the research community.

Lucht"s research interests center on the electrolyte liquid in lithium-ion batteries and its interface with the positive and negative electrodes. Electrolyte promotes the movement of lithium ions between the electrodes, allowing the battery to discharge energy and recharge.

At low temperatures, there"s a higher resistance of lithium ions traveling to the negative electrode, which can result in lithium metal plating on the surface of the graphite negative electrode, Lucht said. "The presence of the lithium metal reduces the calendar life of the battery," he says, "and could result in safety issues such as fire or explosion."

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Low temperatures also affect the rate at which batteries can be charged and decreases the driving range between charges. "The conductivity of the liquid electrolyte decreases with decreasing temperatures. In addition, the resistance of the interface between the electrode and the liquid increases. So, basically it is harder for the lithium ions to go back and forth.

"We"re trying to understand the cause of the poor performance and then systematically design better electrolytes and/or interfaces between the electrolyte and the electrodes to improve the problem," he says.

Lucht previously studied low-temperature performance in the batteries for military aircraft operating in Alaska in the winter and for space applications. Working with Yardney Technical Products, now EaglePicher Yardney, he helped develop novel electrolyte formulations that help improve performance.

Over the years, Lucht"s research has attracted more than $12 million in external funding and he has active contracts and grants totaling more than $1 million. He has worked regularly with government agencies such as the Department of Defense and the National Science Foundation, and private corporations including DuPont, Procter & Gamble, Duracell, BASF, and Samsung.

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