

Dr. Edilso Francisco Reguera Ruiz (center) accompanied by his team of scientists.

IPN to Drive Electromobility with Lithium Battery

A team of researchers, led by CICATA Legaria scientist Edilso Reguera, aims to revolutionize transportation in Mexico City through more sustainable technology.

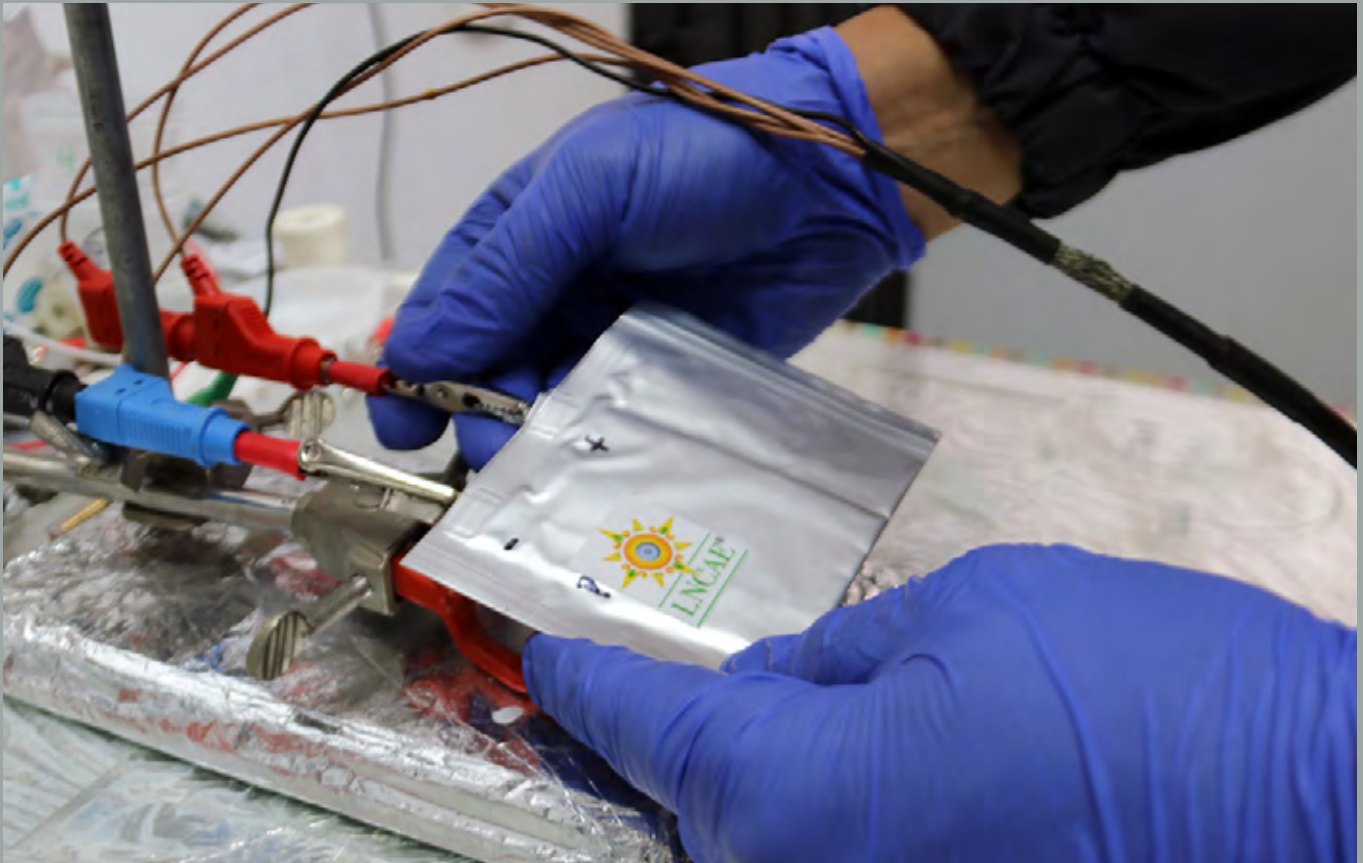
ENRIQUE SOTO

Using state-of-the-art technology, scientists from the Instituto Politécnico Nacional (IPN) have developed a high-performance lithium battery, which was presented to Mexico City (CDMX) authorities to explore the possibility of electrifying mobility. The project considers vehicles such as scooters, bicycles, motorcycles, and even four-seat cars, with the goal of revolutionizing urban transportation and reducing greenhouse gas emissions from fossil fuels.

With the creation of this battery, the IPN fulfilled its commitment to the former head of government of CDMX and now President of Mexico, Claudia Sheinbaum Pardo, to strengthen electromobility in the capital. This initiative has been supported by the Centro de Desarrollo e Innovación Tecnológica (CDIT) Vallejo-i, according to Edilso Francisco Reguera Ruiz, an IPN scientist and professor, emeritus member of the Sistema Nacional de Investigadoras e Investigadores (SNII), and leader of the Laboratorio Nacional de Conversión y Almacenamiento de Energía (LNCAE), which is part of the Secretaría de Ciencia, Humanidades, Tecnología e Innovación (Seciht).



Lithium battery in process





Installation of lithium batteries in scooters

Dr. Reguera Ruiz, who holds a Ph.D. in Chemistry and is originally from Santa Clara, Cuba, reported that his research team submitted a technical report to CDMX authorities. He emphasized that the IPN has taken a major step forward with the lithium battery research project, which is now ready for technology transfer. He also announced that his team is developing a sodium battery, which has promising potential due to its performance and cost. "If we want vehicles with 100% Mexican technology, the batteries must also be made in Mexico," he stated.

ALIGNED WITH LITHIUM NATIONALIZATION

With the recent nationalization of lithium, which now belongs to the nation and will be explored and exploited responsibly, Reguera Ruiz—a scientist at the Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada (CICATA), Unidad Legaria—highlighted that this new legal framework paves the way for IPN's lithium battery technology to become a reality, benefiting Mexican society with the support of the federal government.

"We began working on batteries in December 2016, when the Laboratorio Nacional de Conversión y Almacenamiento de Energía was founded. However, the most significant efforts have been made in the past year with the development of prototypes. Initially, we conducted laboratory studies with small cells, but the bulk of the work has been carried out over the past year," he explained.

He mentioned that the project received funding from the Secretaría de Educación, Ciencia, Tecnología e Innovación de la CDMX (Sectei). The technical report details the performance of the lithium battery, which is packaged in special pouches, similar to those used in cell phone batteries, with parallel sheets inside.

He noted that to move from a pilot scale to industrial production, IPN's batteries would be manufactured in a cylindrical shape, as this improves heat management, manufacturing, and packaging.

"Heat can cause a battery to fail, so efficient heat dissipation is crucial. The core of a battery consists of anode materials (the electrode that receives charge) and cathodes (laminar compounds containing lithium), as well as the electrode tech-

nology used for the charging process. If these elements are well-designed, success is more likely," he emphasized.

He explained that these batteries are structured like sandwiches, with a porous plastic separator between the anode and cathode. The electrolyte bathes all these components, allowing ionic transport.

The lifespan of IPN's batteries depends on their production quality, materials, and usage duration. "They are similar to cell phone batteries, which are used daily throughout the year. These batteries must sustain one charge cycle per day for at least five years, which is approximately the lifespan of a cell phone battery," he said.

FOCUSING ON SODIUM

Dr. Reguera Ruiz stated that if authorities require batteries for scooters, bicycles, motorcycles, or four-seat cars, it will be necessary to build a specialized plant to manufacture them with industrial standards and machinery. "If CDMX authorities decide to produce these batteries, we can scale the technology. Transitioning from laboratory research to mass production requires an intermediate step called pilot plant scaling, which helps identify and solve industrial challenges," he clarified.

Although lithium batteries offer high performance, sodium batteries can be produced at a lower cost. The IPN professor confirmed that his team has already developed a pilot plant project for sodium battery production, which requires an investment of approximately 64 million pesos and could produce up to 500 cells per day.

Mexico has many seawater desalination plants, which generate salt brine mounds that could be used for sodium battery production. These batteries provide 60% of the energy autonomy of lithium batteries.

"If you replace lithium batteries in a vehicle with sodium batteries, autonomy would drop from 500 km to 300 km. However, that is sufficient for a city like Mexico City. Sodium batteries also last longer and are more recyclable than lithium batteries. China already has sodium-powered vehicles on the streets because they are cheaper and provide adequate range," he added.



PATENTS IN PROCESS

Dr. Reguera Ruiz confirmed that the IPN is in the process of obtaining patents for the technology used in its lithium batteries. "However, we already hold patents for some processes related to lithium and sodium projects," he pointed out. He noted with pride that dozens of scientists have earned doctoral and master's degrees through these projects since 2008 when he started working on materials for lithium and sodium batteries.

He emphasized that technological innovation is a matter of national security for Mexico. "Developing our technology strengthens the country, boosts the economy, and enables the creation of Mexican industrial companies without relying on foreign technologies. This also provides jobs for Mexicans, reducing the need to migrate," he stated.

INTERESTING FACT

The lifespan of IPN's batteries depends on their production quality, materials, and usage time. They are similar to cell phone batteries as they are designed for daily use throughout the entire year.

