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Researchers in the Center for Innovative Fuel Cell and Battery Technologies believe that understanding how and why fuel cells fail is the key to both reducing cost and improving durability. The center takes a multidisciplinary approach to fuel-cell and battery research. It serves as a catalyst for development of revolutionary advances through world-class research integrated across disciplines and spanning from fundamental discovery to application-specific prototypes.

Since 2021, Toyota has invested around $17 billion in its U.S. manufacturing operations to support vehicle electrification. The company doubled down on its electrification efforts last March by shifting more than half its research and development staff and budgets to accelerate its work on advanced battery technologies, electrification and software-based vehicles.

"Today"s announcement reflects our commitment to vehicle electrification and further reinvesting in our U.S. operations," Kerry Creech, president of Toyota Kentucky, said in a statement.

In October, Toyota announced plans to invest an additional $8 billion in its EV battery manufacturing plant in Liberty, North Carolina, to support the production of 1.2 million EVs a year for the North American market. The plant is expected to start battery cell production in 2025.

Toyota plans to invest more than $70 billion in electrification by 2030, with hybrid and fully electric models accounting for up to 70% of the company"s U.S. sales by 2030.

By 2025, Toyota plans to launch an electrified version of every Toyota and Lexus model it sells globally. In the interim, Toyota aims to produce 190,000 battery-powered vehicles in 2024 as it prepares to execute its long-term electrification plans.

Batteries. They come in numerous shapes, sizes, and lettered designations; they power everything from telecoms satellites to children"s toys; your TV remote goes through them too quickly and a dead one in your car will have you asking strangers for help.

Like so many items of convenience we only register the impact batteries have on our day-to-day life when they begin to falter. On most occasions these failures are at worst a nuisance, but as the number of hybrid and fully electric vehicles on the market grows, and as more economies aggressively pursue alternative fuel sources, the reliability and longevity of batteries will play a dominant role in how we create, store, and use

energy.

Researching new materials for the next generation of high-capacity batteries is Matthew McDowell, associate professor in the George W. Woodruff School of Mechanical Engineering and director of the McDowell Lab. By understanding how these different materials react to numerous charging cycles, his team hopes to help lead the charge toward longer-lasting batteries.

The complex materials used in batteries were another reason McDowell shifted his academic focus. Batteries have been constructed using a range of elements and minerals, from copper, zinc, lead, and even sulfuric acid. Nickel and lithium are two elements currently in use in lithium-ion batteries. Because of their high energy densities, lithium-ion batteries make up the bulk of batteries in consumer electronics, including those used in electric vehicles.

Still, researchers like McDowell and his team are looking for ways to improve energy density and long-term durability while reducing charging times, which remain obstacles in the electric vehicle market.

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