UC Irvine scientists create long-lasting, cobalt-free, lithium-ion batteries

The finding promises to help manufacturers move beyond controversial metal
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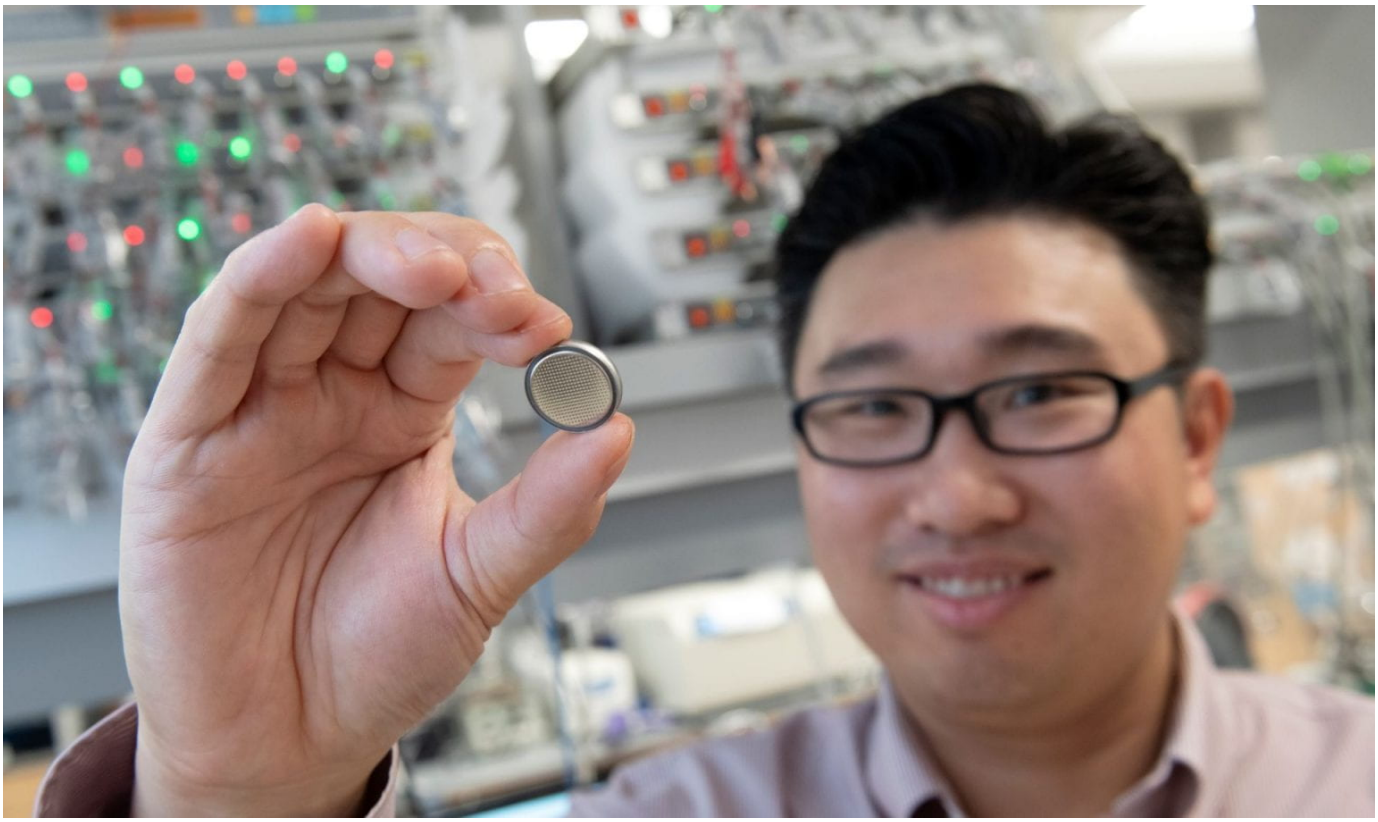

“We are basically the first group that started thinking about the supply chain, or the pain point, that nickel will bring to the EV industry in a matter of, I would say, three to five years,” says Huolin Xin, UCI professor of physics & astronomy, lead author of a paper in Nature Energy on a new way to use nickel in lithium-ion batteries

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Steve Zylius / UCI

Irvine, Calif., June 14, 2023 – In a discovery that could reduce or even eliminate the use of cobalt – which is often mined using child labor – in the batteries that power electric cars and other products, scientists at the University of California, Irvine have developed a long-lasting alternative made with nickel.

“Nickel doesn’t have child labor issues,” said Huolin Xin, the UCI professor of physics & astronomy whose team devised the method, which could usher in a new, less controversial generation of lithium-ion batteries. Until now, nickel wasn’t a practical substitute because large amounts of it were required to create lithium batteries, he said. And the metal’s cost keeps climbing.

To become an economically viable alternative to cobalt, nickel-based batteries needed to use as little nickel as possible.

“We’re the first group to start going in a low-nickel direction,” said Xin, whose team published its findings in the journal *Nature Energy*. “In a previous study by my group, we came up with a novel solution to fully eliminate cobalt. But that formulation still relied on a lot of nickel.”

To solve that problem, Xin’s team spent three years devising a process called “complex concentrated doping” that enabled the scientists to alter the key chemical formula in lithium-ion batteries as easily as one might adjust seasonings in a recipe.

The doping process, Xin explained, eliminates the need for cobalt in commercial components critical for lithium-ion battery functioning and replaces it with nickel.

“Doping also increases the efficiency of nickel,” said Xin, which means EV batteries now require less nickel to work – something that will help make the metal a more attractive alternative to cobalt-based batteries.

Xin said he thinks the new nickel chemistry will quickly start transforming the lithium-ion battery industry. Already, he said, electric vehicle companies are planning to take his team’s published results and replicate them.

“EV makers are very excited about low-nickel batteries, and a lot of EV companies want to validate this technique,” Xin said. “They want to do safety tests.”

About UCI’s Brilliant Future campaign: Publicly launched on Oct. 4, 2019, the Brilliant Future campaign aims to raise awareness and support for UCI. By engaging 75,000 alumni and garnering $2 billion in philanthropic investment, UCI seeks to reach new heights of excellence in student success, health and wellness, research and more. The School of Physical Sciences plays a vital role in the success of the campaign. Learn more by visiting https://brilliantfuture.uci.edu/uci-school-of-physical-sciences/.

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