Team tricks solid into acting as liquid

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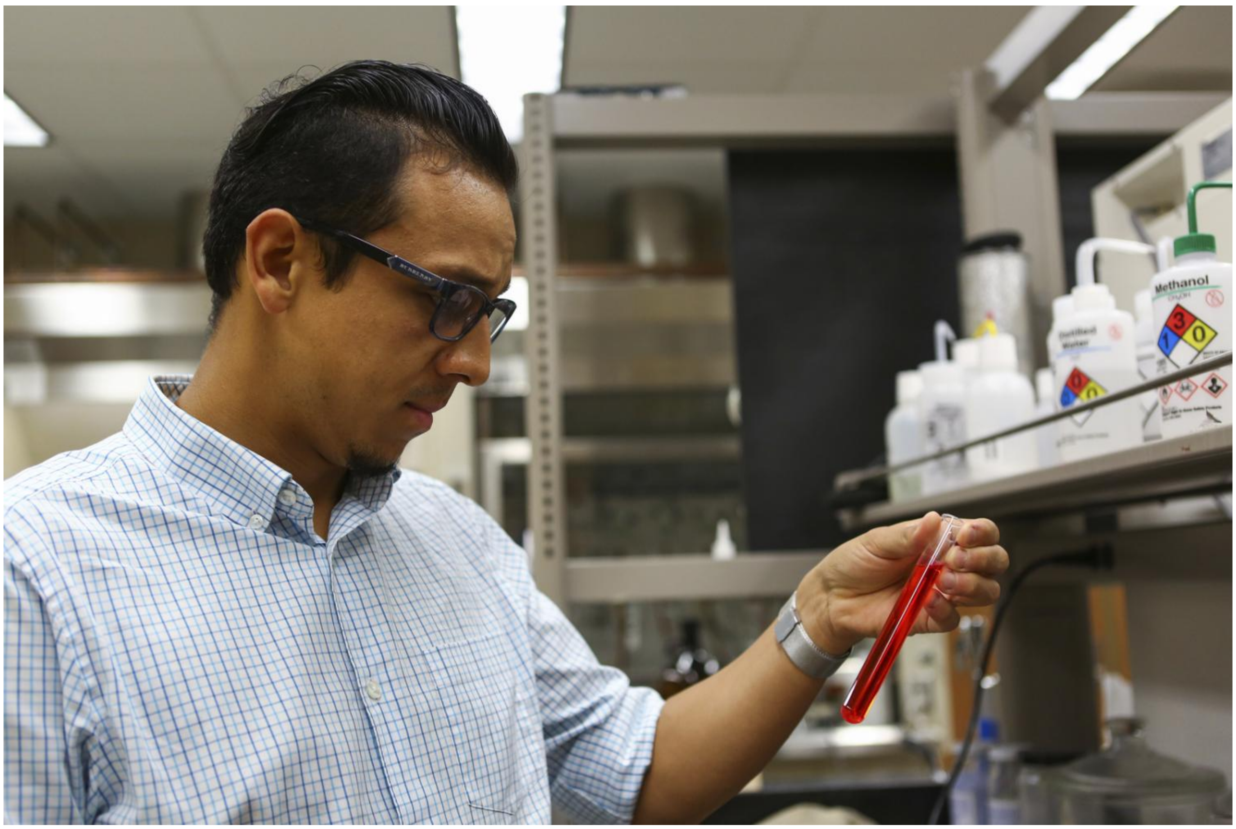

University of Central Florida chemistry professor Fernando Uribe-Romo and one of his students have figured out how to get a solid material to act like a liquid without actually turning it into liquid, potentially opening a new world of possibilities for the electronic, optics and computing industries. Credit: Nick Russett

Two scientists at the University of Central Florida have discovered how to get a solid material to act like a liquid without actually turning it into liquid, potentially opening a new world of possibilities for the electronic, optics and computing industries.

When chemistry graduate student Demetrius A. Vazquez-Molina took COF-5, a nano sponge-like, non-flammable manmade material and pressed it into pellets the size of a pinkie nail, he noticed something odd when he looked at its X-ray diffraction pattern. The material's internal crystal structure arranged in a strange pattern. He took the lab results to his chemistry professor Fernando Uribe-Romo, who suggested he turn the pellets on their side and run the X-ray analysis again.

The result: The crystal structures within the material fell into precise patterns that allow for lithium ions to flow easily - like in a liquid.

The findings, published in the *Journal of the American Chemical Society* earlier this summer, are significant because a liquid is necessary for some electronics and other energy uses. But using current liquid materials sometimes is problematic.

For example, take lithium-ion batteries. They are among the best batteries on the market, charging everything from phones to hover boards. But they tend to be big and bulky because a liquid must be used within the battery to transfer lithium ions from one side of the battery to the other. This process stores and disperses energy. That reaction creates heat, which has resulted in cell phones exploding, hover boards bursting into flames, and even the grounding of some airplanes a few years ago that relied on lithium batteries for some of its functions.

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But if a nontoxic solid could be used instead of a flammable liquid, industries could really change, Uribe-Romo said.

"We need to do a lot more testing, but this has a lot of promise," he said. "If we could eliminate the need for liquid and use another material that was not flammable, would require less space and less packaging, that could really change things. That would mean less weight and potentially smaller batteries."

Smaller, nontoxic and nonflammable materials could also mean smaller electronics and the ability to speed up the transfer of information via optics. And that could mean innovations to communication devices, computing power and even energy storage.

"This is really exciting for me," said Vazquez-Molina who was a pre-med student before taking one of Uribe-Romo's classes. "I liked chemistry, but until Professor Romo's class I was getting bored. In his class I learned how to break all the (chemistry) rules. I really fell in love with chemistry then, because it is so intellectually stimulating."

Uribe-Romo has his high school teacher in Mexico to thank for his passion for chemistry. After finishing his bachelor's degree at Instituto Tecnológico y de Estudios Superiores de Monterreyin Mexico, Uribe-Romo earned a Ph.D. at the University of California at Los Angeles. He was a postdoctoral associate at Cornell University before joining UCF as an assistant professor in 2013.

The findings were pursued by a team lead by Uribe-Romo in collaboration with scientists at UCLA's Department of Chemistry and Biochemistry. It's a partnership the team is pursuing to see if COF-5 is indeed the material that could revolutionize battery and mobile device industries.

Provided by University of Central Florida