

## **Researchers charge ahead to develop better batteries**

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Development of stable lithium-sulfur batteries — which hold more charge than common lithium-ion batteries — could cut back on how often mobile devices need to be charged. Credit: University of Texas at Dallas

Batteries die at the most inconvenient times. Cellphones go dark during important conversations because a battery hasn't been recharged. Or the



automotive industry revs up with excitement for a new battery-powered vehicle, but it needs frequent recharging. Or yardwork is delayed because the battery for your string trimmer is dead.

Researchers at The University of Texas at Dallas have developed a highpowered, environmentally safe lithium-sulfur substitute that could drastically lengthen <u>battery life</u>. Their work has been published in the journal *Nature Nanotechnology*.

"Common lithium-ion batteries only have a certain capacity," said Dr. Kyeongjae "K.J." Cho, professor of materials science and engineering. "And most people want to use their phones for a longer time."

Many smartphone users are familiar with the shelf life of lithium-ion batteries. Sometimes a charge can last roughly a day. Cho said most would agree it would be more convenient if that charge lasted a week or more.

Cho, along with research associate Dr. Jeongwoon Hwang, both of the Erik Jonsson School of Engineering and Computer Science, worked with other regional scientists to improve lithium-sulfur batteries, long considered by many to be an evolution from lithium-ion batteries.

## Lithium-Sulfur Might Be the Solution

Lithium-sulfur batteries have important advantages over lithium-ion batteries. According to Cho, they are less expensive to make, weigh less, store almost twice the energy of lithium-ion batteries and are better for the environment.

"A lithium-sulfur battery is what most of the research community thinks is the next generation of battery," Cho said. "It has a capacity of about three to five times higher than <u>lithium-ion batteries</u>, meaning if you are



used to a phone lasting for three hours, you can use it for nine to 15 hours with a <u>lithium-sulfur battery</u>."

But lithium-sulfur batteries are not without problems. Sulfur is a poor electrical conductor and can become unstable over just several chargeand-recharge cycles. Electrodes breaking down is another reason lithiumsulfur batteries aren't mainstream.

Scientists have tried to improve lithium-sulfur batteries by putting lithium metal on one electrode and sulfur on the other. However, <u>lithium</u> <u>metal</u> often is too unstable, and sulfur too insulating. The scientists discovered a technology that produced a sulfur-carbon nanotube substance that created more conductivity on one electrode, and a nanomaterial coating to create stability for the other.

Cho and fellow researchers discovered that molybdenum, a metallic element often used to strengthen and harden steel, creates a material that adjusts the thickness of the coating when combined with two atoms of sulfur, a coating thinner than the silk of a spiderweb. They found it improved stability and compensated for poor conductivity of sulfur, thus allowing for greater power density and making lithium-sulfur batteries more commercially viable.

"This was what everyone was looking for, for a long time," Cho said. "That's the breakthrough. We are trying to suppress side reactions. It's a protection technology."

Scientists say this finding could change the way we look at batteries and experience <u>battery</u> life.

"We are taking this to the next step and will fully stabilize the material, and bring it to actual, practical commercial technology," Cho said.



**More information:** Eunho Cha et al. 2D MoS2 as an efficient protective layer for lithium metal anodes in high-performance Li–S batteries, *Nature Nanotechnology* (2018). DOI: 10.1038/s41565-018-0061-y

Provided by University of Texas at Dallas

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