

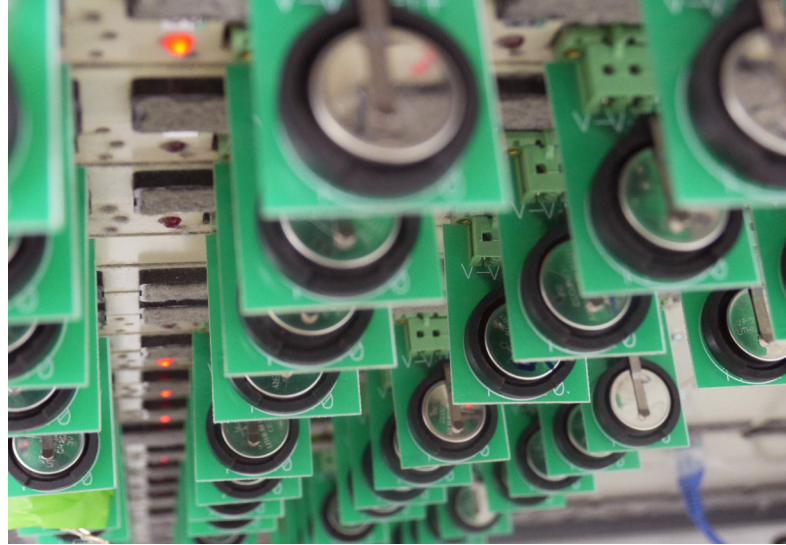
# Next Generation Flexible Rechargeable High Capacity Lithium Sulfur Batteries

*A novel, hybrid and flexible lithium sulfur battery with higher stability, enhanced capacity and enhanced voltage*

The development of high-capacity rechargeable batteries has been pursued intensively in the past two decades, especially for portable electronic devices and electric vehicles.

Technology developed at the KAUST 2D Materials Lab can revolutionize the rechargeable battery industry with significant improvements for energy capacity, cycle life, safety and cost. This invention also overcomes the problems of low sulfur utilization and severe capacity fading that have been associated with previous lithium sulfur batteries.

## TECHNOLOGY OPPORTUNITY



## Benefits

- ▲ High energy density
- ▲ Flexibility
- ▲ Longer cycle life
- ▲ Safety (less risk of fire)
- ▲ Environmentally friendly
- ▲ Stable

## Applications

- ▲ Electronic devices
- ▲ Wearable and consumer devices
- ▲ Energy storage applications

## Opportunity

This technology is part of KAUST's technology commercialization program that seeks to stimulate development and commercial use of KAUST-developed technologies.

Opportunities exist for joint development, patent licensing, or other mutually beneficial relationships.

## For More Information

[ip@kaust.edu.sa](mailto:ip@kaust.edu.sa)

[innovation.kaust.edu.sa](http://innovation.kaust.edu.sa)

## Technology Details

This KAUST technology (patent pending) demonstrates a hybrid lithium sulfur battery with exceptional capacity and remarkable energy density. It addresses the issue of lower sulfur utilization by its unprecedented layer protection, lower lithium diffusion and lower electrical resistance. It has a very high capacity rate and maintains stability for large number of cycles, including at high temperatures.

### How It Works

The technology has an innovative approach to stabilize the sulfur-rich cathode and to utilize the sulfur in the electrode material. A novel pathway and a simple process are employed to protect the sulfur from depleting with a minimum amount of lithium being used. The whole process leads to a battery that is scalable and economically feasible. Testing of the battery is carried out by Arbin Battery Testing System of the USA to measure the Galvano static cycling. In addition, cyclic voltammetry was measured under the scan rate of 0.075–0.25 mV S<sup>-1</sup>, and the resulting electrochemical impedance spectroscopy was acquired with aid of a multi-channel instrument.

### Why It Is Better

The technology developed uses high density sulfur to give the battery increased capacity to meet the needs of current applications.

In addition, sulfur, which is a byproduct of oil and gas processing, is widely available in Saudi Arabia. Sulfur is also recognized as a promising electrode material for next generation Li-S batteries owing to its high theoretical specific capacity. Technologies developed to date suffer from low sulfur utilization and severe capacity fading.

The technology helps in stabilizing the cathode and achieves 100 percent utilization of the sulfur. As a result, an advanced hybrid lithium sulfur battery with an exceptional capacity and impressive energy density is produced

### IP Protection

KAUST has several patents pending for this technology.



جامعة الملك عبدالله  
للعلوم والتقنية  
King Abdullah University of  
Science and Technology

INNOVATION  
AND ECONOMIC  
DEVELOPMENT