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News Release

November 20, 2024

ADEKA CORPORATION

World's First Successful Prototyping and Demonstration of Lightweight Lithium-Sulfur Rechargeable Battery Using SPAN and Resin Film

ADEKA CORPORATION (President and Chief Executive Officer, Representative Director: Hidetaka Shirozume) and URUTAMA.INC have succeeded in the world's 1st trial production[*1] of a lightweight rechargeable battery *"Lightweight Li-SPAN/Resin Film Pouch Cell"*[*2] using a cathode composed of SPAN, a metal-free sulfur-based cathode active material for next-generation rechargeable batteries currently under development by ADEKA, and a resin film. Furthermore, in charge-discharge and safety tests of the prototype cells, the cells achieved a gravimetric energy density of 500 Wh/kg or more and no fire. With these achievements, we have succeeded in demonstrating the world's lightest[*1] battery with excellent ignition safety among those using resin film.

Currently, lithium-ion batteries (LIB) used in cars, airplanes, mobile devices, etc., are facing challenges in terms of their weight, lifetime, and safety. For this reason, research and development of next-generation rechargeable batteries is underway. Lithium-sulfur rechargeable batteries are gaining attention as sustainable and lightweight batteries because they do not use rare metals for the cathodes and use sulfur which is found throughout the world.

Our *"Lightweight Li-SPAN/ Resin Film Pouch Cell"* (prototype) has a maximum gravimetric energy density of 552 Wh/kg, far exceeding the performance of the current LIB[*3]. Furthermore, it was demonstrated that no smoke and fire occurred even when an iron nail was inserted into a fully charged prototype cell with ca. 500 Wh/kg. The demonstration was conducted in cooperation with SoftBank Corp., KISCO LTD., and the National Institute of Advanced Industrial Science and Technology (AIST).

We believe that these achievements will lead to the commercialization of lightweight, safe, and practical (processable) next-generation rechargeable batteries. And we expect this to be used for drones, HAPS (high altitude platform station), eVTOL (electric vertical takeoff and landing) aircraft, and other flying vehicles.

We are currently promoting mass production of SPAN ; *ADEKA AMERANSA SAM series* at its Soma Plant in Japan, and have succeeded in synthesizing more than 100 kg per year, ahead of the world. Our plan is to scale up to several tons per year in FY2026. We will continue to contribute to the practical application of lithium-sulfur rechargeable batteries through the production of SPAN and the prototyping, demonstration, and proposal of various batteries using SPAN, and aim for early commercialization of the materials field.

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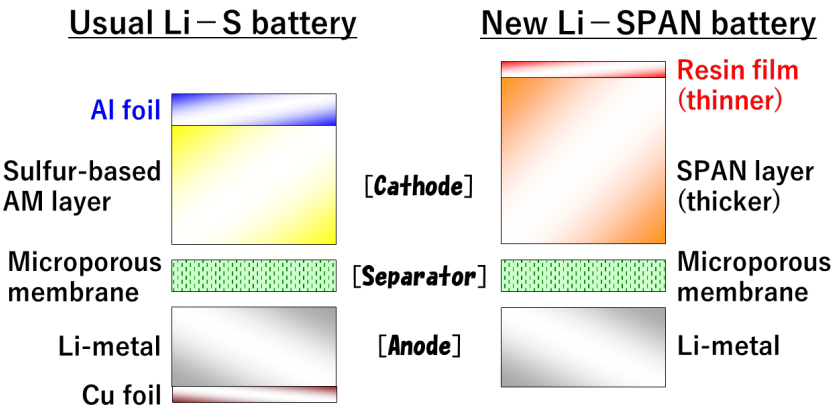
Left) *"Lightweight Li-SPAN/Resin Film Pouch Cell"* (prototype)
Right) Image of HAPS (High Altitude Platform Station)[*4]

◆ About prototype cells

The *"Lightweight Li-SPAN/Resin Film Pouch Cell"* called *"LiLiSPRing-model ADETAMA"* (prototype battery capacity: 9 Ah) used our metal-free sulfur-based polymer material SPAN ; *ADEKA AMERANSA SAM series* for next-generation secondary batteries as cathode active materials. For the current collector of the SPAN cathode, a resin film[*5], which is being jointly developed by KISCO LTD. and SoftBank Corp., was used as an alternative to the current aluminum foil. This is the first battery design in the world[*1] to combine SPAN and resin film. The cell composition was conceived by ADEKA, and the cell design was done jointly by ADEKA and URUTAMA.INC. KISCO LTD. and SoftBank Corp. cooperated in tab welding to the resin film, which is oriented toward practical processes, and URUTAMA. INC cooperated in cell fabrication.



Left) Appearance of the 9 Ah-class prototype pouch cell with Li-SPAN/resn (size of a business card)
Right) Structural schematics of a usual Li-S battery and the new Li-SPAN battery
(electrolyte is omitted)

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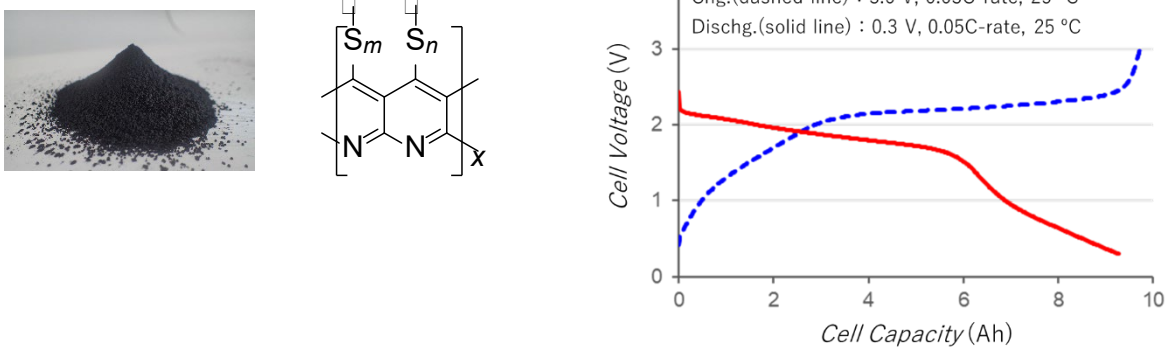
◆ Charge and discharge test of the prototype cells

Charge and discharge tests of the prototype Li-SPAN/resin cells were conducted at the Next-Generation Battery Lab.[*6] of SoftBank Corp. which supports the promotion of next-generation battery developments.

The weight of the prototype cell, including tabs and outer laminated film, was 25.2 g. Based on the capacity (9.27 Ah) and voltage (1.50 V) when discharged at 25 °C and 0.05C, the gravimetric energy density, an indicator of the lightweight character of battery cells, was calculated to be 552 Wh/kg. Charge/discharge cycle performance will be verified in the future.



Left) Appearance and estimated partially structure of SPAN before charge and discharge operations.

Right) Charge and discharge characteristics of the 9 Ah-class Li-SPAN/resin pouch cell (prototype)

◆ Future developments

This result will be presented at the 65th Battery Symposium in Japan. Another presentation on all-solid-state lithium-sulfur battery will also be made. ADEKA will continue to assault the mass production of SPAN, and at the same time, will deepen its collaboration with industry, government, and academia to develop technologies related to next-generation rechargeable batteries and cultivate the market. And we will challenge the early commercialization of lithium-sulfur rechargeable batteries and contribute to a sustainable society.

【The 65th Battery Symposium in Japan / Our information】

Date	Friday, November 22, 2024, 2:40-3:00 p.m.
Venue	Kyoto International Conference Center
Title	Development of “SPAN/Resin Film Cathode|Li-Metal Anode (Li–SPAN/Resin)” Battery Pouch Cell Oriented towards Lightweight, Safety, and Practical Process
Speaker	○Kenji Kakiage[1]、Shunsuke Saito[2]、Hiromi Sato[1]、Toru Yano[1] (1 ADEKA CORPORATION、2 URUTAMA.INC)
URL	https://www.jtbwmice.jp/2024/denchi65/en/index.html

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*1 Researched by ADEKA.

*2 LiLiSPRing-model ADETAMA（Lightweight Li-SPAN/Resin Film Battery-ADEKA & URUTAMA）

*3 The higher the gravimetric energy density, the lighter the battery. Current LIBs have gravimetric energy densities of 150-350 Wh/kg (according to our research). Among the lithium-sulfur batteries developed in the world, 552 Wh/kg is one of the world's best.

*4 Reference (SoftBank Corp.) :
https://www.softbank.jp/en/corp/technology/research/story-event/061/

*5 A current collector with thin Al layers on both sides of a resin film.
Reference (SoftBank Corp.) :
https://www.softbank.jp/en/corp/technology/research/story-event/029/

*6 Reference (SoftBank Corp.) : https://www.softbank.jp/corp/news/press/sbkk/2021/20210315_02/

Supplementary notes: About ADEKA's SPAN

ADEKA is assaulting the mass production of SPAN based on the manufacturing method developed by the National Institute of Advanced Industrial Science and Technology (AIST) and TOYOTA INDUSTRIES CORPORATION. Although we are a materials manufacturer, we are also involved in the prototyping and demonstration of lithium-sulfur batteries using SPAN, and are widely promoting the potential of the SPAN material.

➢ Some of the batteries demonstrated to date :

・Lightweight and long lifetime（500 Wh/kg-cell & >200 cycle）
・New pouch cell designs for Li-SPAN batteries
(Papers Submitted : https://www.researchsquare.com/article/rs-3215804/v1)
・World's highest gravimetric energy density : 800 Wh/kg (special process)
・Prolonged drone flight : 1.8 times more flights than with the current LIB
・Lightweight all-solid-state battery of 350 Wh/kg that operates at 100 °C.

etc.

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