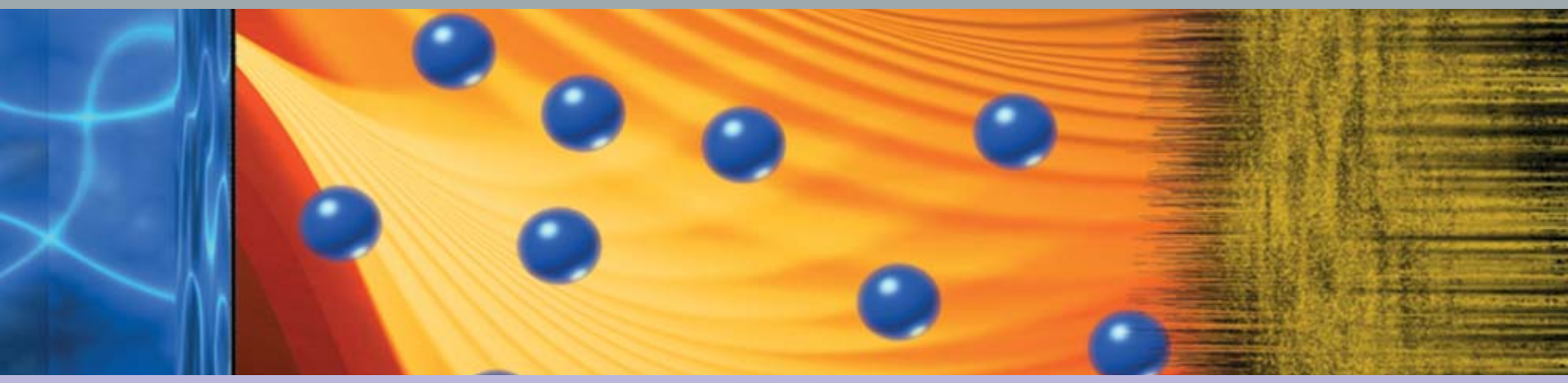
Fraunhofer IWS Dresden

FRAUNHOFER-INSTITUT FÜR WERKSTOFF- UND STRAHLTECHNIK IWS



DEVELOPMENT OF LITHIUM- AND SODIUM-SULFUR BATTERIES

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The task

Lithium-sulfur batteries are characterized by high specific energy and low material costs in comparison to lithium-ion batteries. Herewith, this cell chemistry is extremely attractive for future storage solutions, particularly for the increase of distance range of electric vehicles.

On the basis of sodium-sulfur batteries energy storage devices can be built from raw materials which are available worldwide at low costs. They build an ideal prerequisite for implementations in future energy storage systems for the relief of power supply networks during the further development of renewable energy generation.

Our solution

IWS works on the development of materials, technologies and systems for the manufacturing of lithium- and sodium-sulfur batteries. The main objectives range from material and electrochemical research to the manufacturing of cells and modules.

IWS works on issues alongside the value chain together with industrial and research partners. Newest material science results and findings yield into the manufacturing and evaluation of prototype cells. Thus, new material concepts can be surveyed in a holistic way, and their impact on prototype cell level can be considered.

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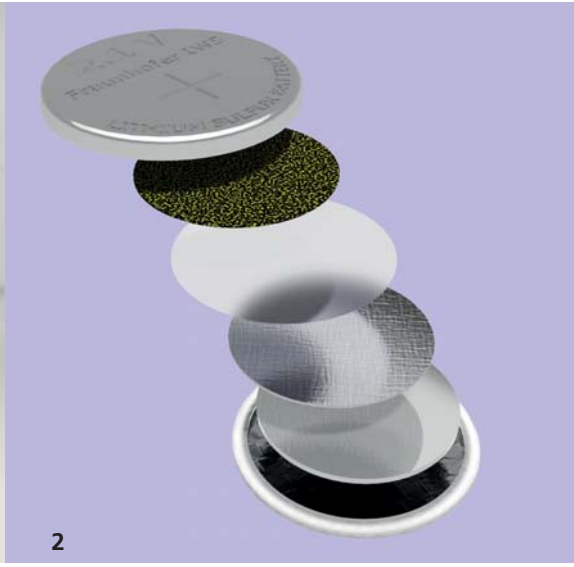

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Carbon-sulfur nano composite cathodes

Fraunhofer IWS investigates high-surface area carbon nanomaterials with tailored porosity. These represent the conductive scaffold structure of the sulfur cathode. For the manufacturing of the electrodes water-based coating processes or alternatively innovative dry film processes are applied. By utilization of template processes porous carbon materials with a surface area of up to 3000 m^2/g and with adjustable meso- and macropores can be made available.

Ion selective separators

By utilization of porous separators with functional polymers it is possible to build an effective barrier for the soluble sulfur species. By such innovative separators a distinct increase of the charging efficiency is enabled. The coatings can be applied on large areas. Due to the low layer thickness the costs of materials and the resistance towards lithium- and sodium-ions are kept very low.

Anodes

Silicon and carbon offer alternatives to lithium, the active anode material of lithium-sulfur batteries. At IWS these diverse concepts are investigated and compared with each other. On the basis of carbon anodes it was possible to demonstrate for the first time 4.000 reversible charging- and discharging cycles in lithium-sulfur batteries.

Electrolyte

The electrolyte material is considered to be a further key component influencing the cathode and anode chemistry of the cell, and is developed and evaluated for lithium-sulfur batteries.

An electrolyte additive for sodium-sulfur cells has been developed at IWS, by which the efficiency, the stability as well as the capacity of the cells at room temperature can be increased. Hereby, over 1000 reversible cycles have been achieved.

Assembly of prototype cells and evaluation

The closed process line at IWS allows building and testing of cells based on raw materials (active powder or electrodes). Manifold possibilities range from pure material evaluation in coin cells to 30 Ah pouch cell prototypes.

Our offer

- evaluation of innovative materials and components for lithium-sulfur and sodium-sulfur cells
- further development of components and cells according to customer requirements
- manufacturing and testing of cell prototypes (coin and pouch cells up to 30 Ah)

1 Dry film cathode and lithium-sulfur prototype cells

2 Test assembly for coin lithium-sulfur batteries