RESEARCH & DEVELOPMENT

Electromobility+

MaLiSu

Nanomaterials for future generation Lithium Sulphur batteries

www.iws.fraunhofer.de/malisu

>> Development of low cost and high capacity Li-S-batteries <<

Project Data

Funding/€	Total cost/€	Duration
1.285.919	1.827.283	36 months

Partners

Fraunhofer IWS, DE | VARTA Micro Innovation GmbH, AT
SGL Carbon GmbH, DE | Uppsala University, SE
Technical University Dresden, DE
Scania AB, Sweden (associated)

Main Results

- Improved fundamental understanding of relation between material structure and battery performance.
- Scalable synthesis and electrode manufacturing processes for porous carbon materials with enhanced properties in sulfur-composite cathodes.
- Identification of electrolyte additives and (mixed) binder systems for improved battery performance.
- Demonstration of material concepts on cell level.

Project conclusion

Within the project a significant contribution to the knowledge on the lithium sulfur battery chemistry was achieved. Carbon materials act as conductive and stabilizing framework for the non-conductive sulfur-species. The influence of the nanostructure in carbons on their performance in sulfur carbon nanocomposite cathodes has been studied. High surface areas (> 1.000 $m^2\ g^{-1}$) and high pore volumes (> 3 $cm^3\ g^{-1}$) were found to be essential for the carbon material to enable high sulfur loadings and utilization. With optimised materials specific capacities of 1.000 mAh g^{-1} (sulfur mass) and 700 mAh g^{-1} (electrode mass) with a stable performance for up to 100 cycles were achieved, thereby exceeding most available literature data.

High performance electrodes were produced through an environmental-friendly dry process route allowing for reproducible results, areal capacities in the range of 2 - 5 mAh cm^{-2} and high current densities up to 10 mA cm^{-2}. The process completely avoids costs related to solvent-based coatings and has the potential to be scaled to a continuous powder-to-roll process.

While material data were collected mainly in coin cells, first pouch cells have been designed and build to demonstrate transferability of results. While the material related data like specific cathode capacity could be reproduced in the prototype cells, achieving high energy densities and high cycle life at the same time, still remains a challenging task.

Future work needs to be focused on anode materials and anode - electrolyte interaction to address the major degradation mechanism in Li-S-batteries.

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

bmvit Federal Ministry for Transport, Innovation and Technology

FFG

VINNOVA

Electromobility+ is co-funded by the European Commission as part of the ERA-NET Plus scheme of the 7th EU Framework Programme under Grant Agreement No. 287143.