6th Issue
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NEWS

Sintbat

Silicon based materials and new processing technologies for improved lithium-ion

improved lithium-ion batteries

In this Issue

Introduction

According to the European Energy Storage Technology Development Roadmap towards 2030 (EASE/EERA) energy storage will be of the greatest importance for the European climate energy objectives.

The Sintbat project aims at the development of a cheap energy efficient and effectively maintenance free lithium-ion based energy storage system offering in-service time of 20 to 25 years. Sintbat will use innovate approaches to address these aims. These include, the latest generation of anode materials based on silicon as well as a prelithiation process for lifetime enhancement will be implemented in the cell manufacturing process. Insights gained from advanced in-situ and in-operando analysis methods will be used for multi scale modelling targeting on the simulation of aging mechanisms for a reliable life-time prediction and enhancement.

The implementation of high energy materials combined with a low cost and environmental benign aqueous cathode manufacturing process will lead to remarkable cell costs reduction down to 130 € per kWh.

This will enable battery based storage system for an economic reasonable price of less than 400 € per kWh (CAPEX) and will lower the OPEX down to less than 0.09 € per stored kWh for the targeted in-service time of 20 to 25 years (10,000 cycles).

The technical developments will be supported by the set-up of a relevant roadmap as well as a catalogue for good practice. To guarantee the highest possible impact for the European economy the Sinbat consortium installed an Industrial Advisory Board including various European battery material suppliers, cell manufacturer and end-users whereby the whole value added chain in this way is completed within the Sintbat project.

This strong interaction of the Sintbat consortium with relevant stakeholders in the European energy economy will assure that battery based energy storage systems are becoming an economic self-sustaining technology.

improved lithium-ion batteries

Project Progress

In this newsletter we would like to give you a brief overview of the latest findings of the Sintbat project.

Project Management (WP 1):

After a term of two and a half years, we were able to achieve a balanced ratio of the use of resources and the corresponding work. The financial situation with the previous disbursements is on schedule. With the publication of this newsletter, we will also reach the end of the second reporting period with the corresponding report due on 30th April 2019.

Research and Development:

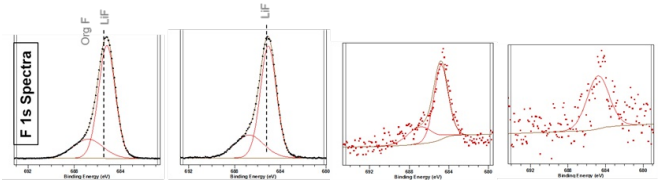
Cell Benchmark, Advanced Electrode Development and Balancing (WP 2):

The ageing evaluation of the prelithiation level in demonstrator cells on Generation 3 using a 3D current collector was finished as well as the formulation recipes and the process transfered to project partner VMB.
An impressive cycle life (more than 90% of capacity retention after 1000 cycles at 100% DOD and 25°C) for prelithiation level was demonstrated. An Original prelithiation process was developed with 2 patents ongoing. The report on Generation 3 cells testing including manufacturing process, electrical tests and post-mortem analysis was finalised.

An aqueous processed positive electrode has undeniable advantages regarding costs, recyclability but challenges as well Corrosion issues were encountered using State-of-the-art materials and process. As a consequence a different process was developed utilizing a carbon coating current collector. Subsequently, different NMC622 grades were examined, which differed, for example, with regard to their pH-value. Thus a further optimized process could be established. The cathode material was used to produce and examine cells. The results indicate that this process is expected to achieve the working goals.

Aging Mechanisms and Tailoring of Electrolytes (WP3):

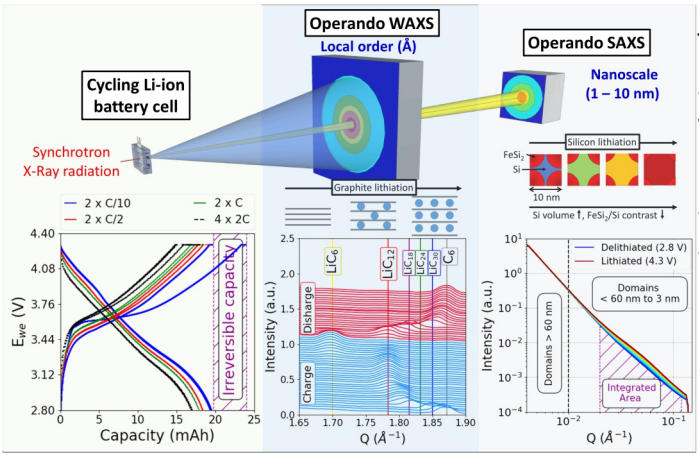
The University of Uppsala has invested a lot of work to decide between the use of fluorinated or non-fluorinated electrolytes. Advanced preparation and analysis methods (e.g. HAPEX at BESSY II Synchrotron, Berlin, see picture on the right) were used. Despite the good results obtained for the non-fluorinated electrolyte, the fluorinated with additives showed better performance. Next steps for UU are to further study the thermal degradation of fluorinated electrolytes and to develop the next generation liquid electrolytes.



The CEA has conducted operando scattering experiments at the Synchrotron (ESRF, Grenoble, beamline BM2) to evaluate the lithiation mechanisms and ageing process in the course of cycling of the anodes, including the

Project Progress

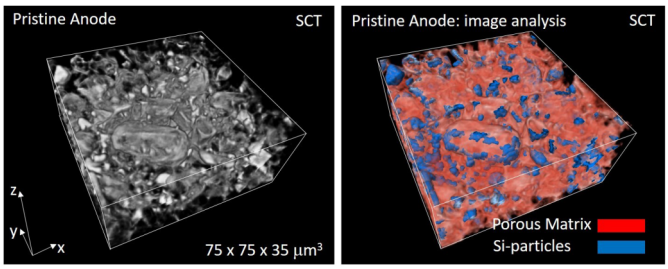
pre-lithiated ones. Combined SAXS/WAXS were conducted on pouch cells on the first cycles, as well as after 300 cycles. The various lithiation steps of the graphite phase were followed in situ by WAXS while the volumic expansion of Silicon domains was monitored by SAXS (see Figure). This unique set-up allowed us to extract the amount of capacity provided by each active (Graphite and Silicon) components during the charge and discharge of the full battery, and their relative variation after long cycling and/or prelithiation, in function of the cycling rate. Next steps are to perform operando tomography experiments in order to obtain the 3D morphology of the electrodes.



Modelling, Simulation and experimental validation (WP4):

MCL has extended the 3D analysis of pristine anode material for various Si contents using XCT to determine a dependence on radius, distance and surface of Si particles. Based on this, experiments were undertaken to optimize manufacturing parameters to improve the production efficiency. In addition, the MCL conducted SCT (synchrotron computed tomography) experiments at the ESRF, Grenoble.

Further analysis on experimental REM/FIB tomography data (Si anode material) provided from project partner CEA (WP3)s was. The experiments and analysis are still ongoing.



Implementation, Cell Development, Analysis and Safety Tests (WP5):

Transfer of advanced materials into industrial scale was started. The electrode production was started, and the material was used to produce coin cells which were tested subsequently in terms of capacity and cycle stability. Test cells (18650 design) with implemented optimised components were build and have been subjected to structural and electrochemical characterization. The cells behave stable in formation and initial cycles. Capacity and capacity stability need to be looked at more closely. The measurements are ongoing.

Project Progress

WP 6 Prototyping and Demonstration:

The module specification and assembly are well advanced. Because of higher energy densities on system level and reduced cost the trend to even larger modules are analysed with a good chance that larger modules will be assembled instead of small-scale modules. The thermal management concept is still under investigation taking Phase Changing Materials (PCM) into consideration to cut temperature peaks and homogenize the temperature profile. In the meantime, the software architecture could be established.
The plan in the upcoming months of the project is to complete the design for battery module, to further optimise the BMS accompanied by extensive testing.

Life Cycle and Health Risk Assessment (WP 7):

In an ongoing and iterative approach, the life cycle inventory data of the conventional VARTA energy storage system, which serves asbenchmark within comparative LCA and LCC studies, is refined. In comparison to literature results, the provision of the battery cell, especially cathode and anode materials, dominates the overall environmental impact and again emphasizes the focus on material and performance optimization.

By implementing silicon particles, one of the main key drivers of sustainability is to identify sustainable silicon production pathways, enough silicon quality, to consider secondary silicon resources and to define an efficient material input to performance ratio, which can be supported by life cycle assessment approaches. Similarly, recycling strategies of cathode materials need to be strongly focused to come up with ecologically and economically sustainable battery systems.

Dissemination, Exploitation and Business Plan (WP 8):

The Market Analysis was completed. Stationary applications on system and pack level for relevant regions and countries are treated in detail as well as cells for portable devices. The Market Analysis is an important building block for the Business Plan which has to be aligned with existing strategy plans on a European level. Therefore, known roadmaps were analysed and taken into consideration showing that the KPI of Sintbat are comparable and well set. The basis for the Business Plan development has been laid successfully.
On behalf of the BMBF (Department of Materials Innovations, Batteries), a brochure with success stories of European research funding is being produced. This brochure will specifically deal with projects in the field of materials research under the FP7-NMP and Horizon 2020-NMP programmes. The Sintbat project was shortlisted for the selection of suitable successful projects.

General Assembly Meeting

Date: 17th-18th October 2018 Location: University of Warwick, Coventry, UK

In October 2018 all project partners met again for the 6th General assembly. This time at the University of Warwick (UoW), which is located on the outskirts of Coventry, West Midlands. University of Warwick is organised into three faculties — Arts, Science Technology Engineering and Medicine, and Social Sciences — within which there are 32 depart-ments. As of 2018, Warwick has around 26,531 full-time students and 2,492 academic and research staff. Warwick consistently ranks in the top ten of all major domestic rankings of British universities. Warwick is ranked 7th in the UK for its research, according to the Research Excellence Framework (REF) and is proud to be among the top 20 'Most International' universities in the world.

On the day before the actual General Assembly, the project partners of WP 3 & 4 used the opportunity for a technical meeting and met with the Sintbat partners arriving early for a joint dinner.

Those present were warmly welcomed at the beginning of the meeting and the agenda was presented. As usual, the work packages were presented in chronological order and intensively discussed. In the morning session the work results concerning advanced electrodedevelopment and balancing, aging mechanisms' and tailoring of electrolytes as well as modelling and simulation were presented.

After lunch the WP Implementation, Cell Development, and Analysis was reviewed. A great deal of space was given to discussing the results and experiences to date, with the aim of outlining a possible follow-up project. The tour of the the Warwick Manufacturing Group (WMG) followed. WMG is an academic department providing research, education and knowledge transfer in engineering, manufacturing and technology. Research is organised into a number of research group covering design, materials, manufacturing, systems and business research. The consortium was allowed to take a close look at the battery research & test facilities. On the morning of the second day the topics concerning Prototyping & Demonstration, LCA & Health Risk Assessment, exploitation and business plan were dealt with. The work package review ended with a presentation on project management.

Over the course of the project, a trustful cooperation has developed, which provides an excellent basis for further project success in the last third of the project term. After all details were clarified the next meeting was scheduled on March 2019 and will take place at Munich, Germany.

Newsflash

BMWi publishes call for proposals for battery cell production

Federal Minister Altmaier: "We need competitive, innovative and environmentally friendly battery cell production in Germany and Europe. Our own know-how in this part of the value chain is crucial for the future market success of our companies. That is why we will support the entrepreneurial initiatives."

The aim is to create a network to produce battery cells of the latest generations, together with other European countries. Project descriptions can be submitted until 15 March 2019.

To cover the value chain of battery production as broadly as possible in the future, the Federal Ministry of Economics plans to make up to one billion euros available.

The funding announcement of the Federal Ministry of Economics and Technology for the planned funding of battery cell production in Germany and Europe was published in the Federal Gazette on 22th February.

https://www.bmwi.de/Redaktion/DE/Pressemitteilungen/2019/20190222-bmwi-veroeffentlicht-foerderaufruf-zur-batteriezellfertigung.html

Shell moves to acquire German storage business Sonnen

In May, oil giant Shell invested in German manufacturer Sonnen. Now the 112-year-old company wants to fully acquire the business, subject to Germany's monopoly authorities. Sonnen said it hopes the deal will accelerate its growth by expanding its market reach and capacity.

The German competition authority's approval for the transaction is pending and sonnen said it believes approval will be granted next month.

The sonnen CEO Christoph Ostermann said Shell New Energies would be a "perfect strategic partner" to help his company expand in a dynamic market. "Especially with regards to the internationalization of our business and up-scaling of our production, Shell will be a strong partner to have our back, that allows us to operate swiftly," Ostermann said. The companies agreed not to disclose details of the agreement.

https://www.pv-magazine.com/2019/02/15/shell-moves-to-acquire-german-storage-business-sonnen/

Picture: Sonnen

Combining e-mobility, photovoltaics & home storage

Everything is networked," said Michael Konder, Innovation Manager E-Mobility from German market leader for solar home storage, Sonnen GmbH.

The 120,000 customers counting circle with the name Sonnen Community combines solar plants, storage system operators and larger producers of renewable energy. Now the electric car is to become part of what the companies say is the world's largest electricity sharing

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platform. Sonnen introduced the SonnenCharger: an intelligent wallbox with two charging modes. The power mode is for the fastest possible loading of self-produced electricity from the roof.
In smart mode, the controller calculates the best possible charging behaviour via its connection to the lithium-ion storage including the household consumption, the best possible charging time and the and weather forecasts.
But an efficient charging box alone is not enough. An innovative loading concept must be integrated into the entire system, since with an increasing number of electric cars more power fluctuations expected. Via an App, customers could choose the preferred charging mode in advance to prevent the car battery from being empty before departure.

ABB also stockpiled its inverters and battery systems with of a charging box. In a study,
which the Swedish technology group commissioned at the TU Munich, Horst Wildemann, Head of the Research Institute Corporate management, logistics and production, predicts for 2030 a Market potential of approximately 4.7 million charging stations in Germany.
According to the economist Wildemann, 2.5 million charging points at private locations and just under 2.2 million at public locations and semi-public locations would be required.

VDI nachrichten · 6. Juli 2018 · Nr. 27/28

Which cell formats are becoming established for lithium-ion batteries

The shape determines the force. So far, no dominant cell format has prevailed. Samsung, for example, produces its cells especially in prismatic form, while LG still primarily produces them as pouches. Panasonic, on the other hand, produces its cells in a cylindrical 18650 shape and will produce them in the 21700 format in the "Gigafactory" in the future. "In view of the emerging economies of scale, future R&D investments, strategic decisions and finally business models of suppliers to the automotive industry and other system integrators are closely related to the standardization and establishment of cell formats," explain the researchers of the Fraunhofer Battery Alliance.
The Fraunhofer Battery Alliance has examined lithium-ion battery cell formats from a holistic perspective. In a current study, the Fraunhofer researchers analyse and evaluate five selected cell geometries up to the year 2025. The cell formats examined are the two cylindrical 18650 and 21700 cell formats, the two prismatic formats of the PHEV2 and BEV2 cells, and a pouch format according to VDA preliminary standard DIN Spec 91252.
The selection of a cell format involves several aspects that are relevant for OEMs, such as the achievable energy density, the geometric dimensions and thus integration possibilities of the cells in modules, the heat development of the cells and the need for thermal management, the safety of the cells, modules and the overall system, as well as the costs of

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cell and module production. In particular, the volumetric energy density depends on the design of the individual cell. Large-format LIB cells will win the race in the long term.

In order to demonstrate the development potential of cell formats, the Fraunhofer researchers have pursued a bottom-up approach from the battery cell through production to the battery module. Under the assumptions made, the individual results of the study regarding volumetric energy density would point to the particularly high potential of the cylindrical formats (18650 and 21700) and the pouch format. In the long term, the highest energy densities should be achieved with larger cylindrical and pouch cells. At the module level, the cylindrical and pouch cells maintained this advantage, but the prismatic cell format had comparatively very good properties regarding cooling the cell formats, which was advantageous for the overall system. The prismatic format also scored best in terms of security but was behind the pouch and 21700 cell formats in terms of cost. The total costs of the cell formats per kWh at module level show that the 21700 cell format will become competitive in the short term due to economies of scale, but that the costs of all cell formats will converge in the long term.

In the medium term, the 21700 format will offer a good alternative and replace the 18650 format. With a view to the rapidly developing electric car models (by 2020 the range will have doubled to over 600 models), which are primarily based on pouch and prismatic cells, it is clear, however, that existing disadvantages of these formats will be offset in the coming years and that large-format, i.e. high-energy, LIB cells are likely to establish themselves in electric cars in the long term.
However, the Fraunhofer Battery Alliance points out that the results of the study are not generally valid, since they depend to a large extent on the assumptions made and individual requirements or a concrete application-specific design in an electric vehicle. However, the multi-criteria analysis and evaluation tool could help to identify the optimal cell formats for the specific application.

https://www.springerprofessional.de/batterie/elektrofahrzeuge/diese-zellformate-setzen-sich-fuer-lithium-ionen-akkus-durch/15365986

A New Battery Could Store Ten Times the Power as Lithium-Ion

Batteries are great. They power many hallmarks of the future, from smartphones to electric cars. The problem, of course, is that batteries never seem to last quite long enough on a charge — and their environmental footprint is substantial.
Now, though, an all-star team of researchers from Caltech, NASA's Jet Propulsion Laboratory, and Honda say they've developed a fluoride-based battery that could deliver up to ten times the energy density of a conventional lithium-ion cell — and that take fewer resources to manufacture.
The team describes the new battery in a paper published Friday in the journal Science. Basically, CNET reports, fluoride batteries have been around for a while — but they required

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oven-like temperatures of around 300 degrees Fahrenheit (150 Celsius) to function. The new battery, according to Caltech and company, can produce power at room temperature.

“Fluoride-ion batteries offer a promising new battery chemistry with up to ten times more energy density than currently available Lithium batteries,” said Christopher Brooks, a Honda Research Institute researcher and a co-author of the paper, in a press release. “Unlike Li-ion batteries, FIBs do not pose a safety risk due to overheating and obtaining the source materials for FIBs creates considerably less environmental impact than the extraction process for lithium and cobalt.”

https://futurism.com/new-battery-ten-times-power

Picture: Kevin Spencer/Emily Cho

Newsflash

Dresden Battery Days 2019

Please note the 3rd Dresden Battery Days meeting on “All-solid-state batteries – already on the way from the laboratory to production?” from September 23–25, 2019 taking place at Fraunhofer IKTS in Dresden, Germany.
This two-day meeting will be dedicated to the exchange of knowledge between international electrochemical energy storage experts on the specific topics of

• Status of research and development of solid-state batteries

• Manufacturing processes for solid-state batteries

• Aspects of future system integration and applications

There will be an opportunity to contribute to the symposium in the form of posters (limited number). Furthermore, we invite you to intensify contacts and topics at the get together as well as the evening program.

There will be an opportunity to contribute to the symposium in the form of posters (limited number). Furthermore, we invite you to intensify contacts and topics at the get together as well as the evening program.

The symposium will be complemented by an industrial exhibition.

For more information please visit:

https://www.ikts.fraunhofer.de/en/communication/events/dbd_2019.html

Event Watch

AsiaSolar PV Expo
AsiaSolar Photovoltaic Innovative Technology Exhibition & Cooperation Forum
18.09. - 20.09.2019 Shanghai, China

ESC - Energy Storage China
11.09. - 12.09.2019 Guangzhan, China

SPI - Solar Power International
23.09. - 26.09.2019 Salt Lake City, USA

EU PVSEC - European Photovoltaic Solar Energy Conference and Exhibition
09.09. - 13.09.2019 Marseille, France

Power Efficiency.Energy-Saving.Innovative Technologies and Equipment
01.10. - 04.10.2019 St. Petersburg, Russian Federation

Solar & Storage Live (formerly Solar Power UK)
17.09. - 19.09.2019 Birmingham, Great Britain

Energy Storage North America (ESNA) - Conference and Expo
05.11. - 07.11.2019 Pasadena, USA

Intersolar India / ees India
The leading energy storage exhibition to secure India's energy supply
27.02. - 01.03.2019 Tokyo, Japan

ENERGY STORAGE EUROPE - Fair and Conference
12.03. - 14.03.2019 Düsseldorf, Germany

eMOBILITY WORLD - Sustainable Mobility Exhibition
The leading trade exhibition dedicated to energy efficient solutions for the
20.03. - 24.03.2019 Friedrichshafen, Germany

Energy / HANNOVER MESSE
Leading international trade fair for integrated energy systems and mobility
01.04. - 05.04.2019 Hannover, Germany

Solar Canada - Canada's Largest Solar Energy Exhibition and Conference
08.05. - 09.05.2019 Calgary, Canada

Consortium

VARTA Microbattery GmbH

VARTA Microbattery (VMB) is an internationally leading and globally active manufacturer of retail and OEM batteries and has been operating for more than 125 years. VMB employs nearly 750 persons in Germany and approx. 2,000 worldwide. The company headquarter is located in Ellwangen in the southern part of Germany where the entire research, engineering and production of the electrochemical cells are done. 150 VARTA employees work in the Innovation Tower at our headquarters in Ellwangen.
This central Research and Development department focuses on developing new products and optimizing existing solutions. Particular attention is paid to material and structural research, converting and storing energy (light, heat, vibration, etc.), and nanotechnologies, fuel cells, and printed batteries.

Uppsala Universitet

Uppsala Universitet (UU), founded in 1477, is the oldest University in the Nordic countries. In all different ranking lists UU is among the top 100 universities in the world. Today, it trains more than 43,000 students, and employs 6,000 people. There are about 2,500 active graduate students; 44% of these are women. Each year, the University awards some 270 doctoral degrees.
The Ångstrom Advanced Battery Centre (ÅABC) is an integral part of the Department of Chemistry – Ångström Laboratory, Uppsala University; it is housed within the Ångström Laboratory – one of Europe's best equipped Materials Research Laboratories. The Centre involves the full-time activities of 35-40 researchers, of whom 8 are Senior Staff and research engineers; the remainders are PhD students and postdocs. It is the leading basic research environments for the development of electrochemical storage materials and advanced battery technology in the Nordic countries. It is publishing more than 20 battery research papers per year. It is a member of ALISTORE-ERI a network of excellence for battery research started more than 10 years ago within FP6. It is a member of SHC (The Swedish Hybrid Vehicle Centre) and of several existing and former FP7 programs.

Consortium

Varta Storage GmbH

The VARTA Storage GmbH (VS) is a developer and manufacturer of stationary battery storage systems. The company has substantial know-how in the field of energy storage by using long-life lithium-ion batteries and conducts in the context of innovative research and development activities. The first commercial product from VARTA Storage is the ENGION Family, a modular storage system which allows the storage of PV-Energy in order to increase the self-consumption of private households up to 70%. With the development of novel large-sized storage systems the company addresses new applications like the efficient use of renewable energies and the support of grid stability.

Commissariat à l'énergie atomique et aux énergies alternatives

CEA is a French government-funded technological research organization. With more than 15,000 researchers and co-workers, its activities cover four main areas: Energy, Defence & security, Health & information technologies, and Fundamental research. Two Institutes from CEA both located on the CEA Grenoble centre are involved in the Sintbat project. CEA-INAC is a fundamental research institute (420 people) involved in nanoscience, while CEA-LITEN is a technological research institute (1,000 people) specialized on energy R&D (fuel cell, batteries, biomass, and solar application).

CEA-INAC develops expertise in advanced characterization on the Nanocharacterisation platform, a large facility devoted to up-to-date electron microscopy, spectroscopy and NMR on the Minatec campus of Grenoble. INAC also manages X-rays beam line at ESRF facility and ILL neutron reactor. For many years, CEA-INAC has developed strong knowledge in LIB investigation and in particular for Si based electrodes. The Nanocharacterisation facility not only provides access to high tech equipment with experienced staff, but also develops new characterisation methods to add to its portfolio.

The Laboratory for Innovation in New Energy Technologies and Nanomaterials (CEA-LITEN) has a unit dedicated to energy for transport application (Department of Electricity, Hydrogen and Transport, DEHT) which has more than 15 years experiences in new materials for Li-ion batteries. Today, this entity is equipped with a dry room of 300 m^2 dedicated to Li-ion batteries prototyping from the electrode material up to the cell and more than 600 m^2 dedicated to Li-ion module and pack system development. CEA-LITEN intellectual properties portfolio on Li-ion batteries is more than 100 on the topics of material synthesis, battery architecture, and BMS.

Consortium

WMG, University of Warwick

The University of Warwick is one of the UK's great success stories. In less than fifty years since being founded the University has become one of the UK's best universities, consistently at the top of UK league tables and rapidly climbing the international league tables of world class universities. Warwick is globally connected, forward-looking and entrepreneurial. At its heart Warwick is about creating new ways of thinking and achieving: making us stand out from our competitors and the more 'traditional universities' and creating an inspiring place to study and undertake research.
As one of the largest academic departments at the University, WMG is able to make a real impact on industry through collaborative R&D and top class education. UK government reviews have cited WMG as an international role model for university and business collaboration. What makes it unique is a multidisciplinary approach to innovation; pushing the boundaries for science and technology and enabling the transfer of knowledge into new areas. Working at the forefront of emerging technologies, and across diverse projects and industry sectors, WMG tackles real world challenges in an environment that inspires confidence and creativity.

MCL Leoben

The Materials Center Leoben Forschung GmbH (MCL) is the leading Austrian institution in the field of applied materials science with around 150 employees. In particular, it is operating the Comet K2 Center on Integrated Research in Materials, Processing and Product Engineering (MPPE) which is the largest competence center in the field of research on application of materials in Austria. The research focuses on Integrated research in materials, processing and product engineering and covers the entire supply chain from material synthesis via materials processing and manufacturing and is also including the behavior of components in service till their deployment. About 50 scientific institutions and about 90 companies are collaborating in this network on material based innovations in the fields of (a) new materials and novel material solutions for future applications like energy storage and harvesting, (b) new and optimized processes and process chains, (c) new design concepts, (d) innovative material driven products, and (d) reliability of products in service.
The MCL has modern Lab equipment suitable for cutting edge failure characterization and material characterization.

Consortium

VARTA Micro Innovation GmbH

VARTA Micro Innovation GmbH (VMI), with registered office in Graz (AUT), is a joint venture between the battery manufacturer VARTA Microbattery (Ellwangen, DE) and Graz University of Technology (AUT). The business purpose of VARTA Micro Innovation GmbH is R&D in the area of electrochemical energy storage systems. Within VARTA Micro Innovation both, the industrial fabrication know how from VARTA Microbattery and the basic research know how from Graz University of Technology for various electrochemical energy storage systems are merged together. This unique configuration enables VARTA Micro Innovation to perform a fast transfer of newly developed technologies into production state. The R&D activities of VMI are divided in three main research areas:

Lithium Power - Improvement of specific energy (Wh*kg-1) and energy density (Wh*l-1)
Heat Power – Enlargement of the temperature operation range
Rapid Power – Improvement of the rate capability

VARTA Micro Innovation is highly experienced in research, reverse engineering and ordered analysis in the area of lifetime prediction and reliability of Li-Ion Batteries for different application fields (e.g. EV, storage etc.). VARTA Micro Innovation has also many years of experience in working with high capacity negative electrode materials for lithium ion batteries. This work includes on the one hand basic research of high capacity electrode materials as well as electrode fabrication and construction of batteries with these materials on prototype level.

EurA AG

EurA AG has been established in 1999. As an innovation service provider, EurA advises more than 800 mainly medium-sized companies in Germany, covering all industrial sectors. EurA mainly focuses on consulting and assisting companies in national and European R&D projects. This comprises the entire innovation process, including the generation of promising ideas, the search for suitable partners, the establishment of the project consortium, the technical and administrative coordination of the project as well as the project controlling.

Consortium

Uniwersytet Warszawski

University of Warsaw (UW) was founded in 1816. The University brings together scholars from a variety of disciplines. It is the place of a diversity of scientific research. Nearly 60,000 people study at the University of Warsaw every year. The candidates are offered a very broad range of courses in the fields of humanities, social sciences and natural sciences, as well as many interdisciplinary courses combining knowledge and skills of many disciplines. The University offers undergraduate and doctoral studies, organizes summer schools, postgraduate studies and vocational courses, initiates interdisciplinary programmes and introduces new teaching techniques.
The Faculty of Chemistry, University of Warsaw, is a large research and teaching centre. There are fully developed programs in analytical chemistry, biochemistry, inorganic, nuclear, organic, and physical chemistry as well as in chemical physics. The faculty has been regarded as one of the top chemistry departments in the country for decades, and it attracts outstanding faculty and students. Many faculty members have distinguished themselves both nationally and internationally.

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Sintbat