



**MERRY CHRISTMAS
AND HAPPY NEW YEAR**





ONE YEAR OF ACTIVITIES

HIGHSPIN IS FUNDED BY THE EUROPEAN UNION'S HORIZON EUROPE RESEARCH AND INNOVATION PROGRAMME UNDER GA NO. 101069508.



CIRCULAR ECONOMY



BATTERY



PATTERN



PLANE



CAR



HIGHSPIN

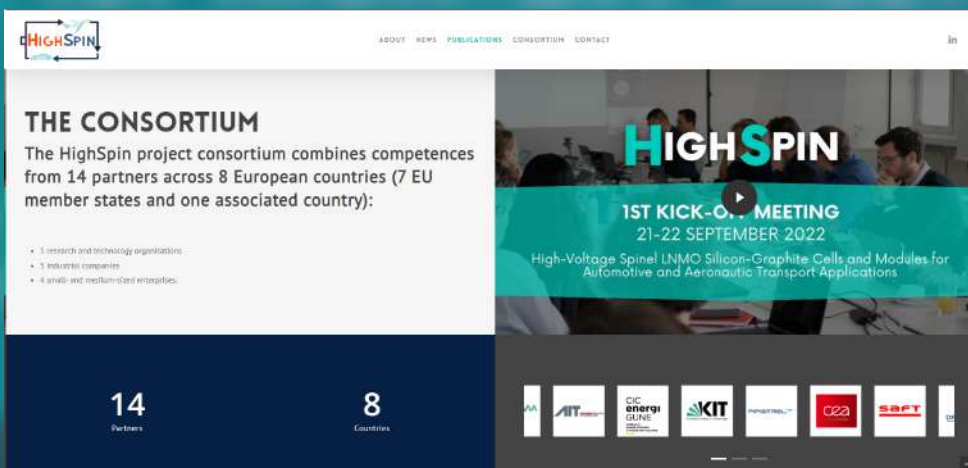
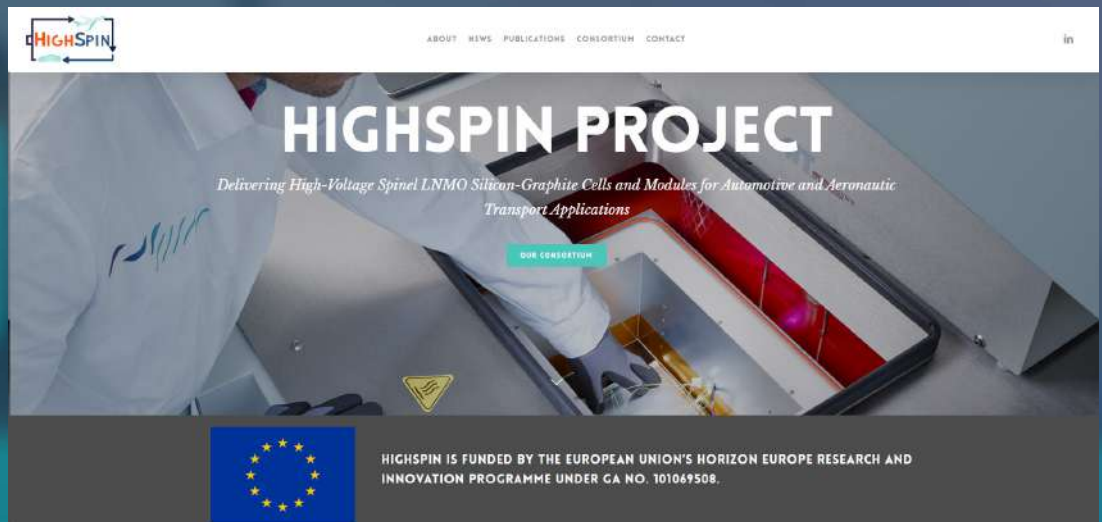
Selected font for the lettering:
LEIXO

BRAND IDENTITY

We designed the entire brand identity of HighSpin, from logo, templates, infographics to icons; taking care to reflect the main focus of the project. For example, if you look closely at the lettering of the logo, you will notice a pattern with an “LNMO” morphology. This pattern represents the materials research being conducted by our team to develop next-generation Li-ion batteries that will support electro mobility.

WEBSITE

We have launched the HighSpin Website!
On the website you can find an overview of the project, deliverables and publications and keep up to date with HighSpin news.



POST

We have been keeping you updated every week on the project's progress, through infographics, articles, posts and videos; and more news awaits you in 2024. Spoiler alert! We have recorded interviews with some of the project partners. Keep an eye out for the upcoming video!



HighSpin Project

The quest to make better orth is ON

This excerpt from a conference poster by Emina Hadzialic et al. shows a group of eight #EU-funded projects that have a focus on #batteries for #automotive

Batteries for the Future

automotive aeronautics

3BELIEVE HELENA MATHISSE SOLIFLY ORCHESTRA INOTHEP HECATE

HighSpin HighSpin HighSpin HighSpin HighSpin HighSpin HighSpin

Free of critical raw materials High Performance Batteries Integrated Energy Structural Integration High Performance Batteries High Performance Batteries High Performance Batteries

AIT PIPISTREL FACC AIRBUS LEONARDO

...read more

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HighSpin PARTNERS



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This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement no. 101069508.



PARTICIPATING ORGANISATIONS

- 1 AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH
- 2 CENTRO DE INVESTIGACION COOPERATIVA DE ENERGIAS ALTERNATIVAS FUNDACION CICE ENERGIAGUNE FUNDAZIOA
- 3 HALDOR TOPSOE AS
- 4 FORSCHUNGSZENTRUM JÜLICH GMBH
- 5 KARLSRUHER INSTITUT FUER TECHNOLOGIE
- 6 PIPISTREL VERTICAL SOLUTIONS DOO PODJETJE ZA NAPREDNE LETALSKE RESITVE
- 7 SAFT
- 8 CUSTOMCELLS GROUP
- 9 ARKEMA FRANCE SA
- 10 COATEX SAS
- 11 SENSICIPS SRL
- 12 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- 13 LEAD TECH SRL
- 14 VIANODE AS

The HighSpin project consortium combines competences from 14 partners across 8 European countries (7 EU member states and one associated country) and is coordinated by AIT Austrian Institute of Technology.

HighSpin is scheduled to run from SEPTEMBER 1ST, 2022 TO AUGUST 31ST 2026, for a total of 48 months.

14 PARTNERS **48** MONTHS **8** COUNTRIES



HighSpin

Delivering High-Voltage Spinel LNMO Silicon-Graphite Cells and Modules for Automotive and Aeronautic Transport Applications

BROCHURE

We have represented the project in brief in the HighSpin brochure, including the key activities, objectives, abstract and consortium.



ABOUT THE PROJECT

HighSpin aims to develop high-performing, safe and sustainable generation 3b high-voltage spinel LNMO||Si/C material, cells and modules with a short industrialisation pathway and demonstrate their application for automotive and aeronautic transport applications. The project addresses in full the scope of the HORIZON-CL5-2021-D2-01-02 topic, setting its activities in the "high-voltage" line. The project objectives are:

- Further develop the LNMO||Si/C cell chemistry compared to the reference 3beLiEve baseline, extracting its maximum performance;
- Develop and manufacture LNMO||Si/C cells fit for automotive and aeronautic applications;
- Design and demonstrate battery modules for automotive and aeronautic applications;
- Thoroughly assess the LMNO||Si/C HighSpin technology vs. performance, recyclability, cost, and TRL.

The HighSpin cell delivers 390 Wh/kg and 925 Wh/l target energy density, 790 W/kg and 1,850 W/l target power density (at 2C), 2,000 deep cycles, and 90 €/kWh target cost (pack-level). The project activities encompass stabilisation of the active materials via microstructure optimisation, the development of high-voltage electrolyte formulations containing LiPF6 and LiFSI, ultrafast laser-structuring of the electrodes, and the inclusion of operando sensors in the form of a chip-based Cell Management Unit (CMU). HighSpin will demonstrate TRL 6 at the battery module level, with a module-to-cell gravimetric energy density ratio of 85-to-90 % (depending on the application). Recyclability is demonstrated, targeting 90 % recycling efficiency at 99.9 % purity. HighSpin aims at approaching the market as a second-step generation 3b LNMO||Si/C in the year 2028 (automotive) and 2030 (aeronautics), delivering above 40 GWh/year and 4 billion/year sales volume in the reference year 2030.

HIGHSPIN TARGETS

Materials

Cathode with 3.0 g/cm³ density and anode with 20 wt. % of Si (730 mAh/g capacity). Stable electrolyte up to 5.0 V.



Processes

3D electrode multilayer coating and ultrafast laser structuring at a speed of ≥ 5 m/min against LNMO||Si/C.

Demonstrators

LNMO cells at 390 Wh/kg and 925 Wh/l at a cost target of 90 €/kWh (pack level). 300 cells/150 CMUs produced and 2 sets of module demonstrators delivered at TRL 6.



Assessment

Testing as part of the materials development, assessment of the performance in 1st and 2nd life (including LCA, costs, and TRL). Demonstrated recyclability, at 90 % recycling efficiency.

Time-to-market

TRL scale-up of the HighSpin LNMO||Si/C to enter the market as "second-step Gen. 3b" LiB in 2028 (automotive) and 2030 (aeronautics).



Our team

A team of more than 60 researchers are involved in HighSpin, with 3 Ph.D. students supervised, one each at KIT, FZJ and CICE.



TO ACHIEVE THE OBJECTIVES, THE KEY PROJECT ACTIVITIES ENCOMPASS:

- ✓ Stabilisation of the active materials via microstructure optimisation
- ✓ The development of high-voltage electrolyte formulations containing LiPF6 and LiFSI
- ✓ Ultrafast laser-structuring of the electrodes
- ✓ The inclusion of operando sensors in the form of a chip-based Cell Management Unit (CMU)





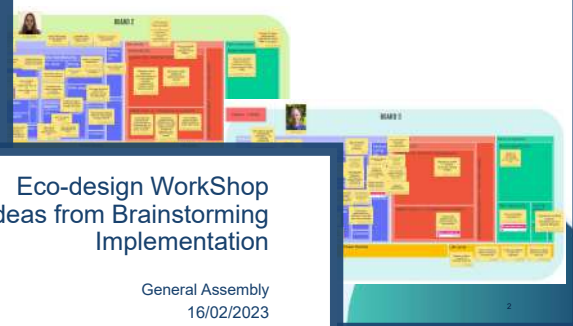
We attended the 3rd General Assembly of HighSpin in Victoria-Gasteiz, Spain, hosted by CIC energiGUNE. During the assembly, partners discussed the progress of all the activities carried out over the current year, actively comparing the next steps to follow. After the meeting, a guided tour of CICEnergiGUNE's laboratories followed.





About the Brainstorming

- Context: Achievement of an eco-design approach from the beginning of the project (T0+3 months)
- Brainstorming on positive impactful ideas starting from a representative treemap organized in subgroups and two rounds.



About the implementation

- Context: Implementation of the impactful ideas from the brainstorming with the WP Leaders.
- Decision-making about the ideas : To be followed, to be tested, already planned

Impactful ideas

High energy density active materials ★★★★★
 Increase active materials capacity
 Use of LMNOs for new battery use of Ni & Li, etc.
 Use of high energy density electrode materials
 Use boosting additives for increase the capacity

→ 4 participants (WP Leaders), 1 face

05/04/2023

Eco-design WorkShop Ideas from Brainstorming Implementation

General Assembly
16/02/2023

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This publication reflects only the author's view and the European Climate, Infrastructure and Environment Executive Agency (CINEA) is not responsible for any use that may be made of the information it contains.

Scrap and used

MNO) ★★★★★
 materials from cell recycling to determine if it
 is used in a battery pack (active materials,
 consider whether they could have any other
 manufacturing) (LMNO) ★★★★★

Fix targets

Fix quantified target (ex - minimizing CO2 emission per kWh delivered by the battery in its life) and constraints (ex - battery durability), and explore/compare systematically these different solutions in (pre)design phase

4/5/2023

Material diversity reduction (pack-module)

Materials diversity reduction ★★★
 Do not mix mineral & synthetic materials (like in a composite)

Already planned – WP5

To be evaluated – WP4

4

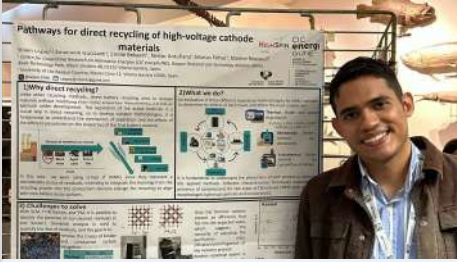


WORKSHOP

During the general assembly held online on 16 February, the HighSpin consortium organized a workshop featuring a brainstorming session. During this session, project partners identified potential actions to address the escalating demand for batteries with significant sustainability challenges.

HighSpin Project

CIC energiGUNE's PhD student, Stiven López Guzmán, present his research he is conducting in HighSpin project at the International Congress on Metals for Electric Mobility in Nancy, France, held on September 19-20.



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HighSpin Project

Final day of the Battery Innovation Days 2023 event, a key European Research & Innovation initiatives



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HighSpin Project


18th A3PS Conference Eco-Mobility 2023: How to achieve 100% sustainable mobility? Circular Economy – from Cradle to Grave and back to Cradle



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HighSpin Project


The Batteries Europe 2nd Plenary Session will take place in Brussels, on 7 June 2023 from 10:30 to 17:00PM CEST.



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HighSpin Project

The results from 3BeLiEVe, and the preliminary findings of #HighSpin and MATISSE Project will be, among others, crucial for informing the revision of the Batteries Europe Working Group 5 roadmap




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HighSpin Project

Michele De Gennaro
Senior Scientist - Scientific Project Coordinator
Expert in green technologies and sustainable aviation (A3PS) - Chair

The first day of the Clean Aviation Annual Forum is gone, in an inspiring and constructive atmosphere.



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EVENTS

Here are a few of the events in which we took part this year, showcasing the HighSpin project.



The ELECTRIC Plane with a \$0 fuel cost

Batteries

AIT develops energy-dense batteries for electric aircraft

September 29, 2023

David Kotrba

The European project aims to produce cobalt-free, easily recyclable and high-performance batteries for vehicles and aircraft.

There are already some aircraft that fly with electrically powered propellers and batteries on board. Their biggest problem is that batteries are heavy relative to how much electricity they can store. Increasing this low energy density is also important in order to advance electrification in road transport.

The European research project HighSpin is trying to develop a battery that has a value of 390 Watt hours per kilogram comes. Lithium-ion batteries currently in use have values of around 200 Wh/kg. With higher energy density, electric vehicles and aircraft should either go further with the same weight or the same range with smaller and lighter batteries achieve.

Salzburger Nachrichten

AIT develops powerful batteries for electric aircraft

from

SN

Thursday

October 12, 2023

00:00

f t i n k

1 comment

Print article

New electricity storage should offer higher energy density and do without the raw material cobalt.



The aim of the research is a small electric aircraft.

Due to their heavy weight, lithium-ion batteries have so far only been used in aviation in exceptional cases. Currently there are only a few, relatively battery-electric aircraft available for test operations.

MEDIA

If you didn't catch it earlier, here you can find the articles about HighSpin, along with a report available on YouTube!





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THANK YOU FOR YOUR ATTENTION

