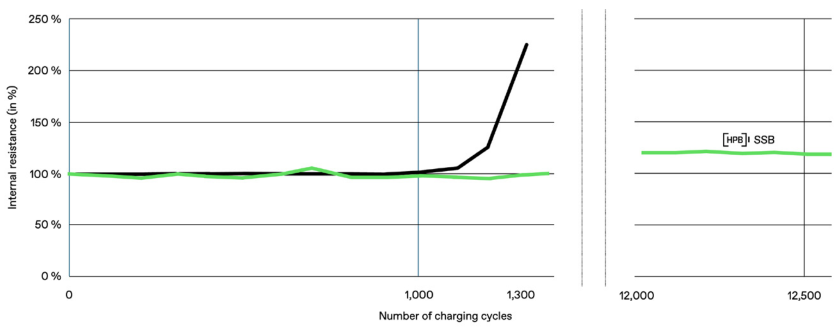
HPB Technology – Engineered to store renewable energy in a safer and more sustainable way.

To ensure a neutral assessment, HPB activities are consistently monitored scientifically by external experts.

HPB Solid-State Battery | Cycle Life Characteristics
(>12,500 and ongoing) 1C/1C, 0-100 % SOC, RT



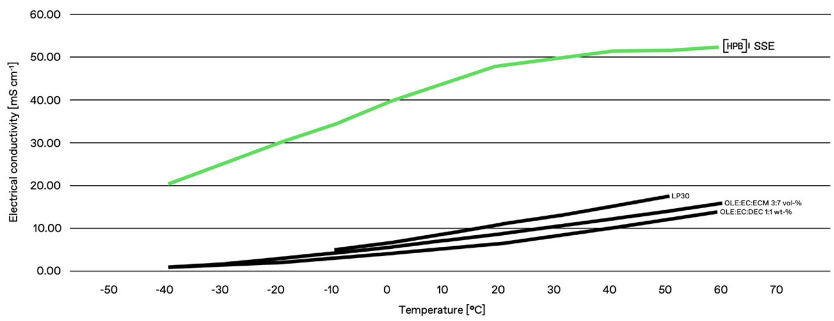
>12,500 and ongoing

While conventional lithium-ion batteries have to be replaced after about approx. 1,250 charging cycles* – with hourly charging and discharging – the HPB Solid-State Battery currently has at least 12,500 charging cycles, with a comparable load.

Since these cycle life test cells have not yet reached the end of their life, this number will continue to increase steadily.

*Source: https://www.sciencedirect.com/science/article/pii/S2666546821000355

HPB Solid-State Electrolyte | Conductivity Characteristics
temperature range: from -40°C to 60°C

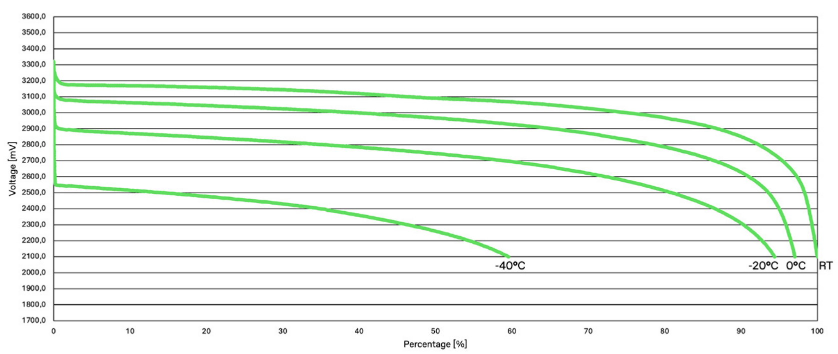


Higher conductivity over the entire temperature spectrum

Compared to the liquid electrolytes commonly used today, the HPB Solid-State Electrolyte has an enormously improved conductivity. This is decisive for the available power from the battery cell. The HPB Solid-State Electrolyte shows an absolutely higher conductivity at minus 40 °C than conventional liquid electrolytes at their optimum at plus 60 °C.

Sources: [1] J. Landesfeind, H. A. Gasteiger. J. Electrochem. Soc. 2019, 166(14), A3079-A3097. URL: https://iopscience.iop.org/article/10.1149/2.0571912jes | [2] T. R. Jow, K. Xu, O. Borodin, M. Ue (Ed.), Electrolytes for Lithium and Lithium-Ion Batteries, 2014, Modern Aspects of Electrochemistry Vol. 58, Springer, New York. | [3] T. B. Reddy (Ed.), Linden's Handbook of Batteries, 2010, 4th ed., McGraw-Hill Education Ltd.

HPB Solid-State Battery | Discharge Capacity Charactersitics
Charge: CC-CV 0.5 C 3.6V, 0.1 C cut-off at 25 °C (RT)/Discharge: 1C cut-off at 25 °C (RT) / 0° C / -20° C / -40° C



High performance at low temperatures

Where other batteries without external battery heating give up, the HPB Solid-State Battery is still in its comfort zone: Even at -20 °C, the extractable capacity is more than 90 % – tested at a robust discharge rate (1C). This is a real game changer for the use of batteries in winter.

If you would like to carry out your own measurements with HPB Technology, please contact FEV Europe GmbH.

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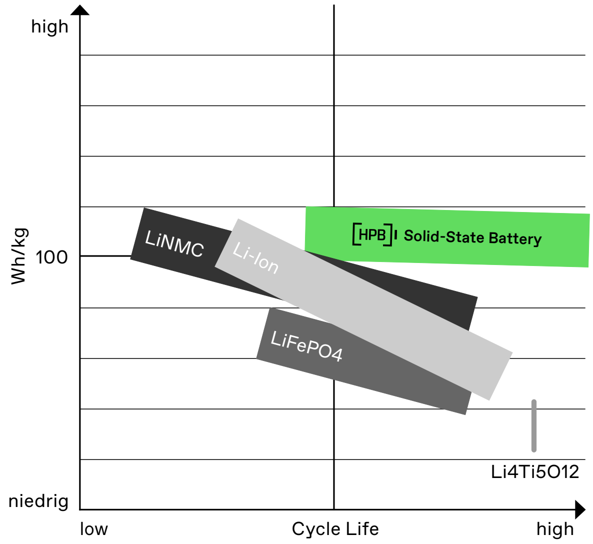
HPB Technology in technology comparison.
The following charts provide a rough indication of how the outstanding properties of HPB Technology can be categorised in comparison to the current competition.

HPB Solid-State Battery | Wh/kg and cycle life
technology comparison with Li-Ion, LiNMC, LiFePO4 and Li4Ti5O12



Longer lasting and smaller dimensions.

A key parameter of battery storage systems is their specific energy: the maximum amount of electrical energy that can be stored in relation to the battery mass, expressed in watt hours per kilogramme (Wh/kg).

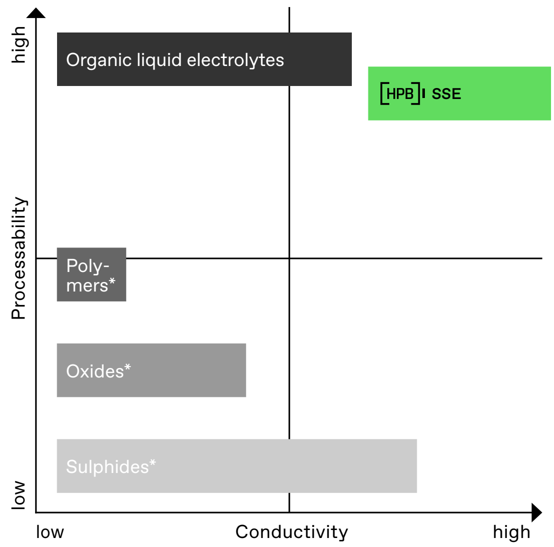
With stationary storage systems, the specific energy generally decreases with increasing cycle life, which must be compensated for by larger battery storage systems depending on the application – with consequences for resource requirements and the environment.

Compared to other long-life storage systems, the HPB Solid-State Battery also has significantly higher specific energies in the long term. A battery storage system with HPB Technology can therefore be dimensioned significantly smaller for an identical application.

When selecting a storage system, the specific energy parameter must be considered in the context of the other battery characteristics. For example, the fast-charging capability (C-rate) is another lever for resource efficiency. We have clearly summarised these relationships in our white paper „Rightsizing“.

Source: https://www.highperformancebattery.ch/global/downloads/211008_Impulses_for_the_energy_transition_-_Rightsizing_-_but_the_right_way.pdf?m=1636392926&

HPB Solid-State Electrolyte | Conductivity and processability
technology comparison with polymers, oxides and sulphides as well as conventional organic liquid electrolytes



*Solid-state electrolyte

More conductive and easy to process.

The HPB Solid-State Electrolyte (SSE) achieves outstanding conductivity values across the entire temperature spectrum and therefore not only outperforms conventional organic liquid electrolytes, but also the conductivity values of other solid-state electrolytes (polymers, oxides and sulphides).

Compared to other solid-state electrolytes (polymers, oxides and sulphides), however, the HPB Solid-State Electrolyte is much easier to produce, as it can be manufactured due to known production processes from conventional lithium-ion batteries with liquid electrolytes.

In a two-stage process during cell production, the starting materials for forming the HPB Solid-State Electrolyte are first introduced from the production of the raw electrode to the electrode stack. By adding the final components in liquid form, similar to the liquid electrolyte filling of conventional lithium-ion batteries, the chemical reaction to form the HPB Solid-State Electrolyte in the battery cell begins.

The conductivities and the specific challenges of industrial production of the other solid ion conductors (polymers, oxides and sulphides) are clearly described in the Fraunhofer Institutes “Solid-state batteries Roadmap 2035+” study.

Source: https://www.isi.fraunhofer.de/content/dam/isi/dokumente/cct/2022/SSB_Roadmap.pdf

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