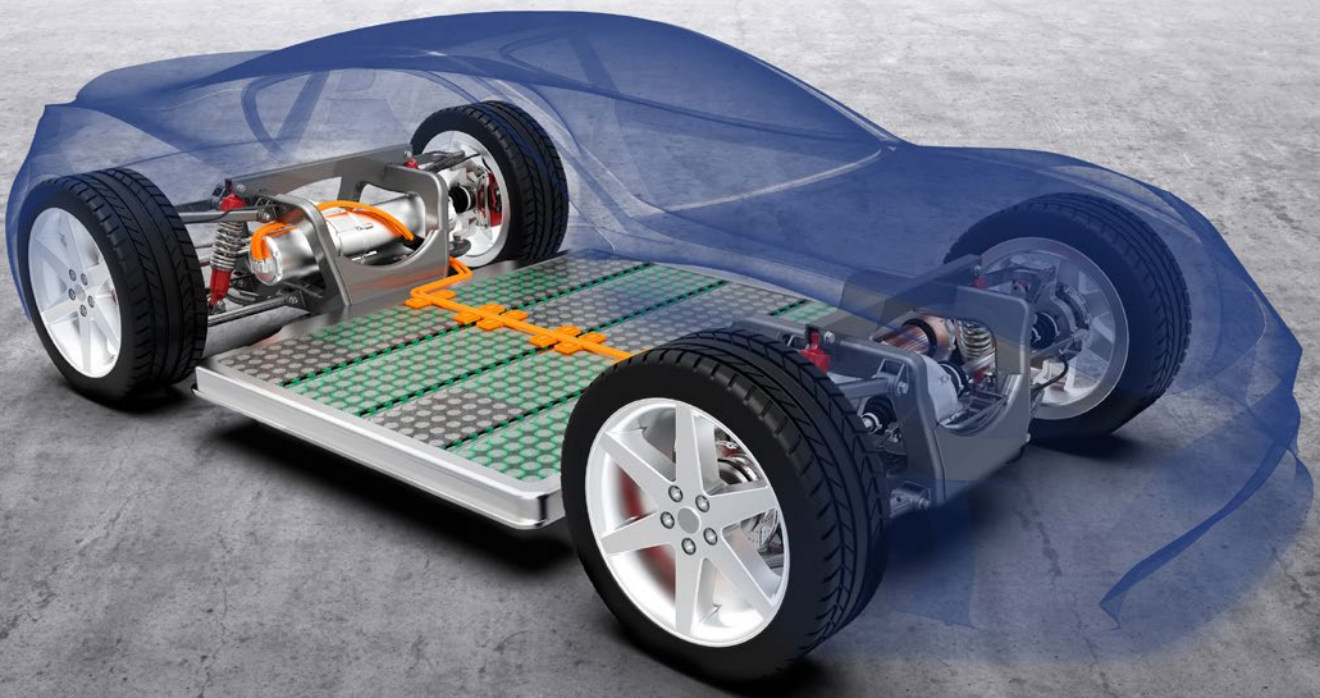


RECYCLING OF LITHIUM-ION BATTERIES

Maximum raw material recovery

TRANSFORMING
MATERIALS INTO VALUE



Effective battery recycling is essential for the responsible and economical use of raw materials, but is associated with challenges: Sophisticated processes are necessary to recover the maximum amount of raw materials in the best possible quality. At the same time, the safety of people and the environment must be ensured.

BHS-Sonthofen offers an efficient and safe process with which batteries can be recycled in an environmentally friendly and safe manner - and valuable raw materials such as copper, lithium, nickel, cobalt or manganese can be returned to the value cycle.

Advantages

- ✓ Highest process reliability
- ✓ Maximum raw material yield
- ✓ Various sizes in modular design
- ✓ Global service

FROM ENERGY TO RAW MATERIAL

Innovative and safe recycling process for batteries.

Fossil fuels are to be gradually replaced by other energy sources. The production of accumulators and batteries as storage media for regenerative energies is increasing. As a result, the need for economical recycling methods is also increasing.

BHS-Sonthofen offers an efficient and safe process for recycling lithium-ion batteries in an environmentally friendly and safe manner. The aim is to return valuable raw materials such as copper, lithium, nickel, cobalt, and manganese to the value cycle. Almost all types of disused battery modules and cells as well as production waste can be optimally processed using this method.

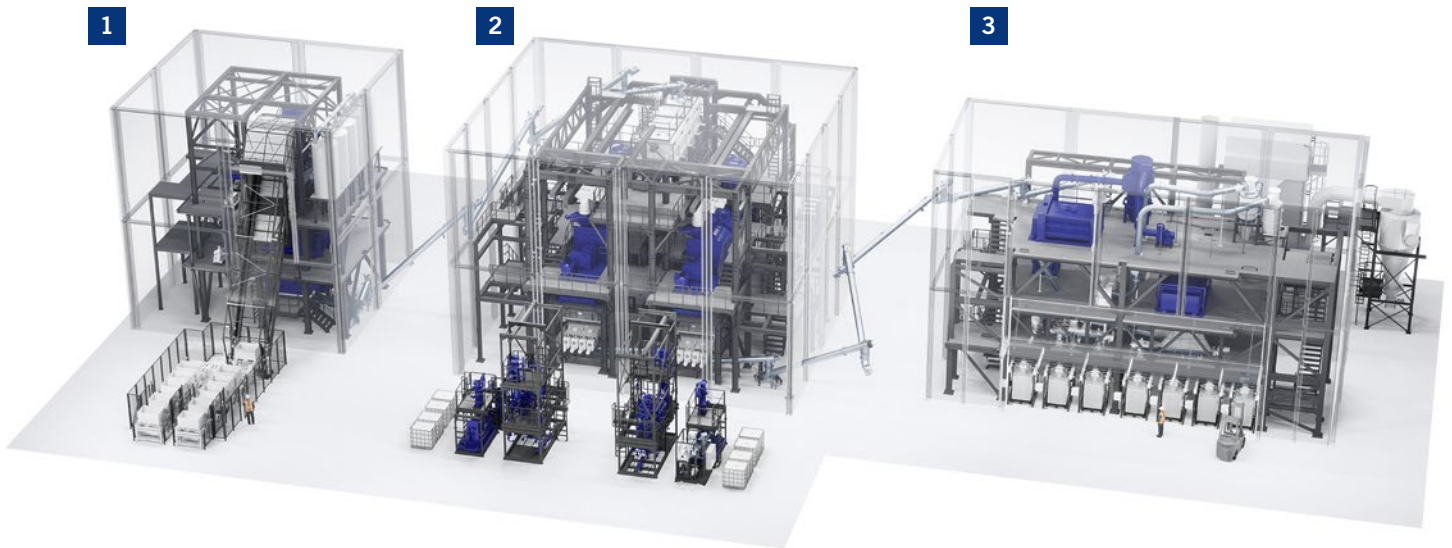


[Get more details](#)

[www.bhs-sonthofen.com/
battery-recycling](http://www.bhs-sonthofen.com/battery-recycling)

INNOVATIVE PROCESSES AND TECHNOLOGIES

The three-stage, dry mechanical BHS-process.



Module 1 | Shredding

The BHS shredding process takes place in two stages. In the first step, the feed material is shredded using a sturdy rotary shear (VR). In the second step, the pre-shredded material is fed into the universal shredder (NGU). Both machines in special gas-tight design.

- ✔ Optimum material digestion for the subsequent process steps, thanks to BHS technologies
- ✔ High flexibility towards the feed materials

Module 2 | Vacuum drying & Gas condensation

In the second stage, the shredded material is dried in the vacuum dryer (HTC). The electrolyte is then recovered in liquid form using a vacuum and condensate unit.

- ✔ Exhaust gas flow is neutralized
- ✔ Optimum preparation for the recovery of dry black mass
- ✔ Low-boiling organic components are condensed out
- ✔ Process reliability for further treatment

Module 3 | Separation & sorting

In the final stage, the output material from the dryer is further shredded and screened. This allows the following four output fractions to be recovered: the black mass, a mixed fraction containing metal, a foil fraction and the heavy material.

- ✔ Black mass optimized for hydrometallurgical processing
- ✔ Variable process control to optimize the quality and quantity of the black mass

Advantages of the BHS Process

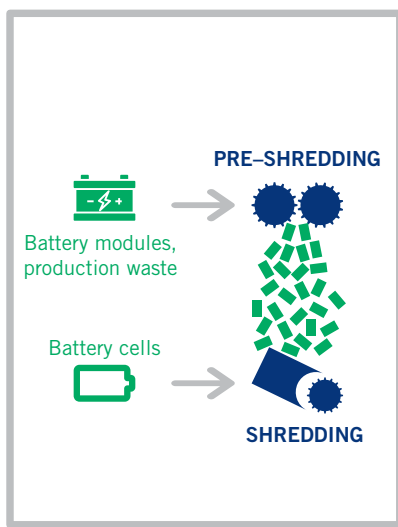
- ✔ High recycling rate >95%
- ✔ Large variety of recovered raw materials
- ✔ Highest process reliability
- ✔ High degree of process maturity

MAXIMUM MATERIAL RECOVERY

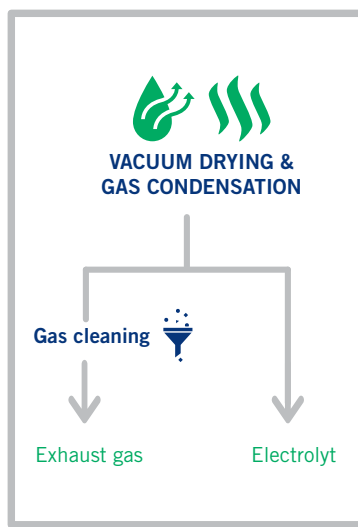
Sustainable. Safe. Efficient.

The safe process from BHS-Sonthofen relies on dry mechanical treatment and is based on a three-stage process: shredding, drying and sorting. The primary aim is to achieve optimum recovery of the black mass:

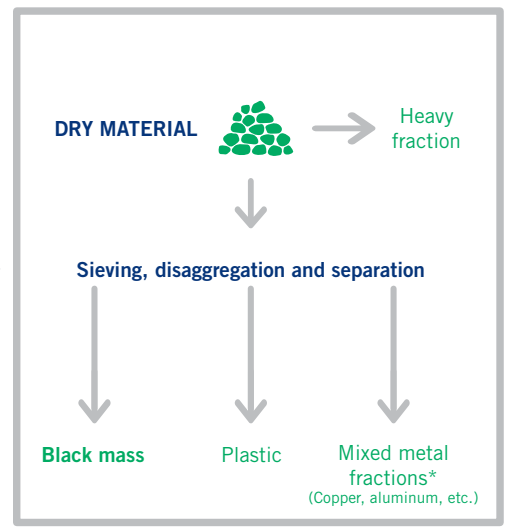
Module 1 | Shredding



Module 2 | Vacuum drying & Gas condensation



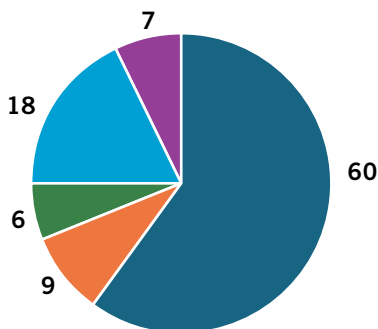
Module 3 | Separation & sorting



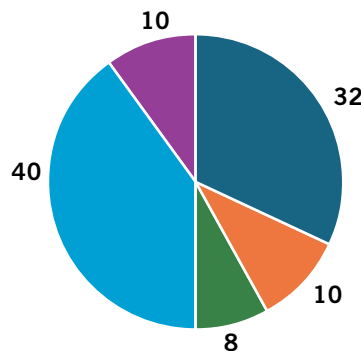
*optional further separation

Variability of valuable end products using the example of a battery module

After the three-stage BHS process, there is a variety of valuable end products. The distribution of these is highly dependent on the type and composition of the feed material. While the proportions of electrolyte, foil fraction and mixed metal fraction are relatively similar, there are significant differences for the heavy fraction and the black mass.



End products Battery type 1



End products Battery type 2

- Black mass
- Foil fraction
- Electrolyte
- Mixed fraction
- Heavy fraction

TECHNICAL EXPERTISE AND ADDED VALUE

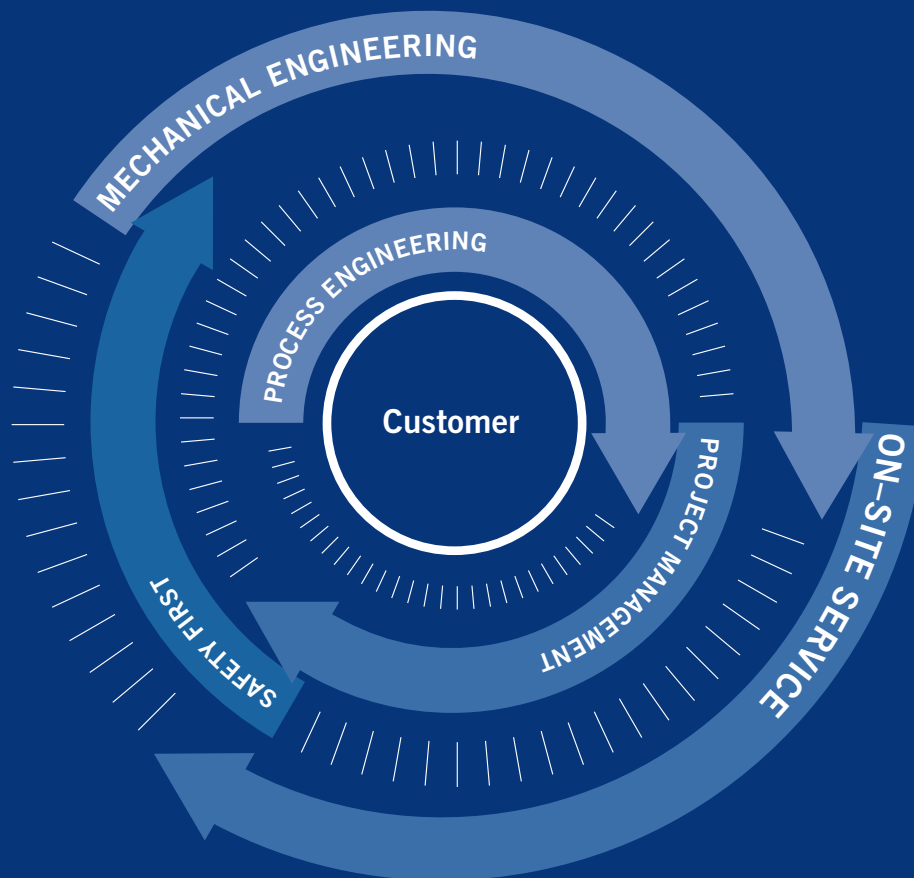
Our core competencies for your process.

1 Process engineering

Many years of experience and countless test evaluations are the basis for maximum process efficiency: the aim is to achieve high output qualities and recovery rates with minimized operating costs. Safety is our top priority.

2 Project management

We work with you to plan and implement your system. We always keep time and costs in view. We are experts in plant engineering in the field of recycling technology and process technology. Cross-industry know-how allows us to make optimum use of synergy effects. With us you get everything from a single source - from planning, production and purchasing of plant components, expediting, acceptance, installation to commissioning on site.



3 Safety first

The development of a safe recycling process for lithium-ion batteries - using risk analyses, HAZOP studies and ATEX expertise - is based in particular on the many years of experience in plant engineering and the in-depth process expertise in the BHS Process Technology division. In addition to reliable process development, the greatest challenge in this application is the design of a safe system concept with regard to ATEX, environmental and workplace regulations. The BHS process ensures this in full.

4 Mechanical engineering

BHS produces the key components of the BHS process itself in order to guarantee quality and adherence to delivery dates for critical components. In addition to the components from shredding, drying and sorting technology, BHS-Sonthofen offers a continuously developed process control system with in-house control solutions

5 On-site service

Even the smallest parts can have a major impact if they no longer work. BHS ORIGINAL PARTS are perfectly matched to our machines and systems and meet the highest quality requirements. Take advantage of our fast supply of wearing parts with over 10,000 immediately available parts and keep your downtimes as short as possible.

THE BEST WAY TO SHAPE THE BATTERY FUTURE

Most efficient process to recover pure battery raw materials.

During the recycling of battery modules, cells, and production waste from battery manufacturing, a variety of valuable output materials are reclaimed. In addition to the black mass, this includes a diverse range of metallic fractions such as aluminum, copper, and foil. Through the innovative recycling process developed by BHS-Sonthofen, approximately 95% of the materials present in a battery can be effectively recovered and separated. This encompasses essential elements like copper, aluminum, plastics, and the crucial black mass.



[Whitepaper Download](#)

The efficient recycling of lithium-ion batteries:
Read all about the opportunities, challenges, and various process involved with recycling lithium-ion batteries.



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