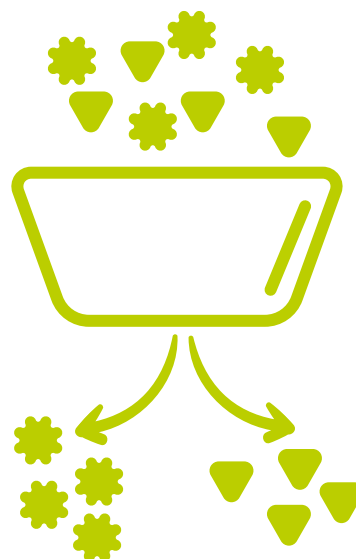


## Accurate sorting: the foundation for direct recycling

Direct recycling only works if the input material is clean and contemporary enough to reuse. REVITALISE's fragmentation processes break down manufacturing scrap and end of life batteries gently, avoiding the excessive heat and grinding that intimately mix and contaminate materials in conventional shredding.

The result is separate anode-rich and cathode-rich black mass fractions, sorted and graded against defined quality parameters, with higher grade fractions routed to direct recycling and lower grade material sent to hydrometallurgy.



### RESULTS IN PRACTICE

- Defined quality parameters set which fractions are suitable for direct recycling
- Reduced contamination of undesirable metals in anode and cathode fractions
- Clean separation of active material from contaminants
- Higher value end materials, with lower processing cost to return them to use

**>99%**  
**purity**

cathodic black mass suitable  
for direct recycling

### PAIN POINTS ADDRESSED

- Value lost when black mass is mixed or contaminated before downstream processing
- High energy cost of processing unsorted material through full hydrometallurgy
- Difficulty proving black mass quality to downstream buyers

**<1%**

metallic contamination

## TECHNOLOGY IN DETAIL

### How it works

**Stepwise separation processes, suitable for scaling.** First, cells are triaged to evaluate their condition and sorted based on cathode chemistry. Then, cells are broken into their constituent parts for separation (maintaining materials at a coarse size) before anode/cathode separation, and finally separation of foils from battery materials using fragmentation methods in preference to milling processes. This produces separate anodic and cathodic black masses of contemporary active materials.

### What goes in

**Independent of battery chemistry.** The technology has been demonstrated so far on NMC, LMO-NCA and LFP cells. The crucial first step: having accurate information about the battery chemistry and condition before deciding the best downstream process route.

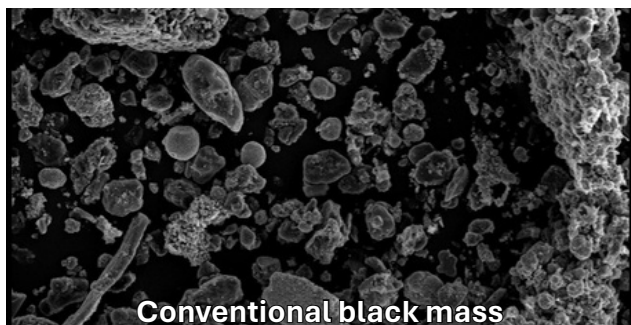
### What comes out

**Black mass graded for direct vs hydro recycling.** The outputs of this phase of the process are anode-rich black mass and cathode-rich black mass. Cathode-rich black mass has been demonstrated with >99% purity, as recently published.

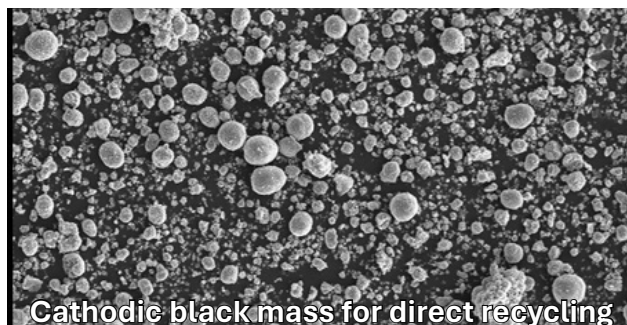
### What sets it apart

**Better black mass = better recovery rates overall.** Conventional processing grinds anode and cathode materials together, presenting a mixed black mass not suitable for direct recycling, which must be sent for hydrometallurgy. But excessive Al and Cu contamination may challenge the cost-effectiveness of hydrometallurgical routes. Both of these issues are avoided in our new approach.

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Conventional black mass



Cathodic black mass for direct recycling

**revitalise-project.eu**

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