HELMHOLTZ

WORLD RESOURCES FORUM '23

HZDR HZB KIT TU BERGAKADEMIE FREIBERG UFZ

Spitzenforschung für große Herausforderungen.

FineFuture

Innovative technologies and concepts for fine particle flotation: unlocking future fine-grained deposits and Critical Raw Materials resources for the EU

FINEST

From **FineFuture** to **FINEST**...

...towards a more sustainable circular economy

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World Resources Forum'23 | 2023-09-04 | Geneva

Motivation: climate-neutrality/energy transition

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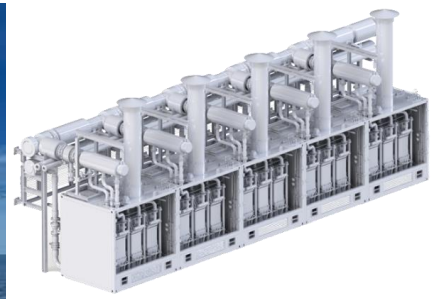
Large amounts of base metals and CRMs are required to **decarbonize industry and society**

Secure supply at manageable costs and **acceptable CO_2 footprint** is a challenge.

+

Exhaustion of natural ore deposits and more complex composition of the ores

➜ more valuables finely disseminated with mineral processing technologies having problems with fines

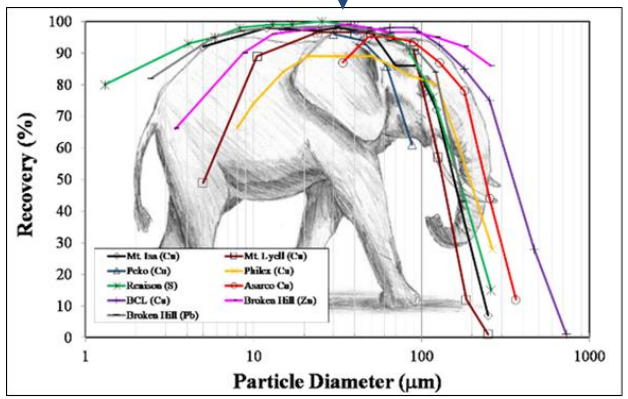


Platinum

Copper

Losses of up to **30%**

huge environmental and safety problems



FineFuture: Consortium and Project Idea

FineFuture **Innovative flotation technology based on fundamental understanding**

Magnesite Ores

GRECIAN MAGNESITE

MAGNA MAGNESITAS NAVARRAS

MAGNESITE IS A TRUE CELEBRITY MINERAL
Sculptures are not made of it. Almost everything else is, e.g.:

- Crucial and irreplaceable refractory material
- Various applications in the chemical industry
- Important for fertilizer production

Copper Ores

KGHM POLSKA MIEDŹ

COPPER – THE BASE METAL FOR ELECTRIC GRIDS, DIGITALIZATION…

Manganese Ores (Gabun)

eramet

MANGANESE ORES – for steelmaking and foundry activities, chemical uses: batteries, animal feed, water treatment

BASF We create chemistry · eramet · GRECIAN MAGNESITE · HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF · Imperial College London · IMA Europe · iWN · ITU · KGHM POLSKA MIEDŹ · MAGNA MAGNESITAS NAVARRAS · MAELGWYN MINERAL SERVICES · POLITECNICO MILANO 1863 · ТУРБОФЛОТСЕРВИС TURBOFLOTSERVICE

Complex ores,
e.g. Chalcopyrite with quartz

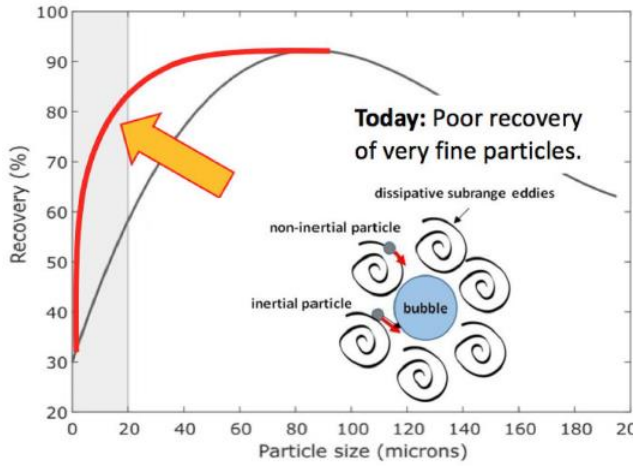
Mineral processing

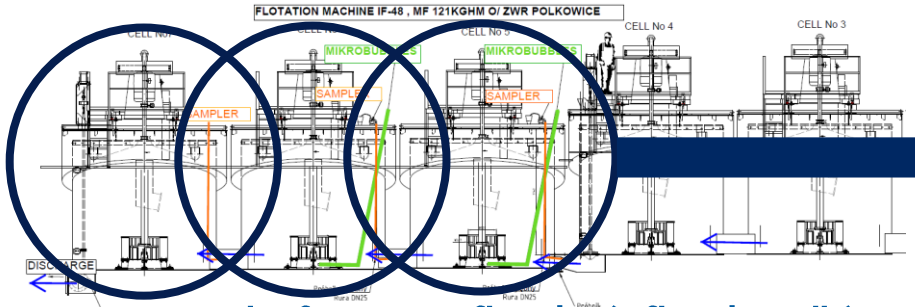
Ore concentrate

Smelter &
Refinery

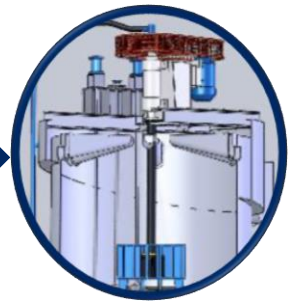
Copper

FineFuture: from lab via pilot to (semi) industrial scale

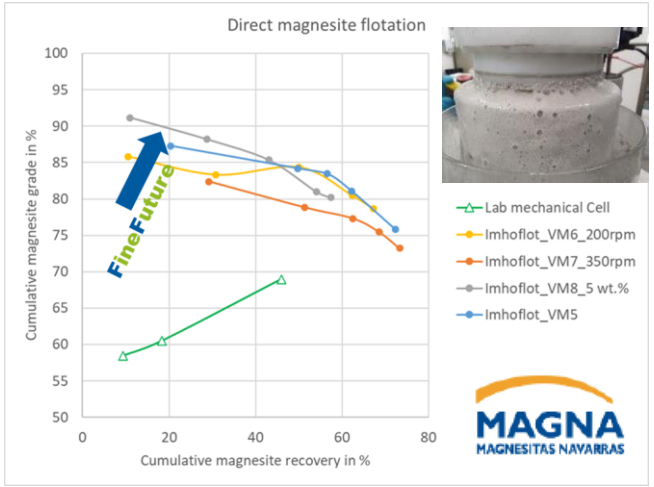




Last cascade of scavenger flotation (3 flotation cells)



IF type 48m³ flotation cell



Motivation: sustainable circular economy

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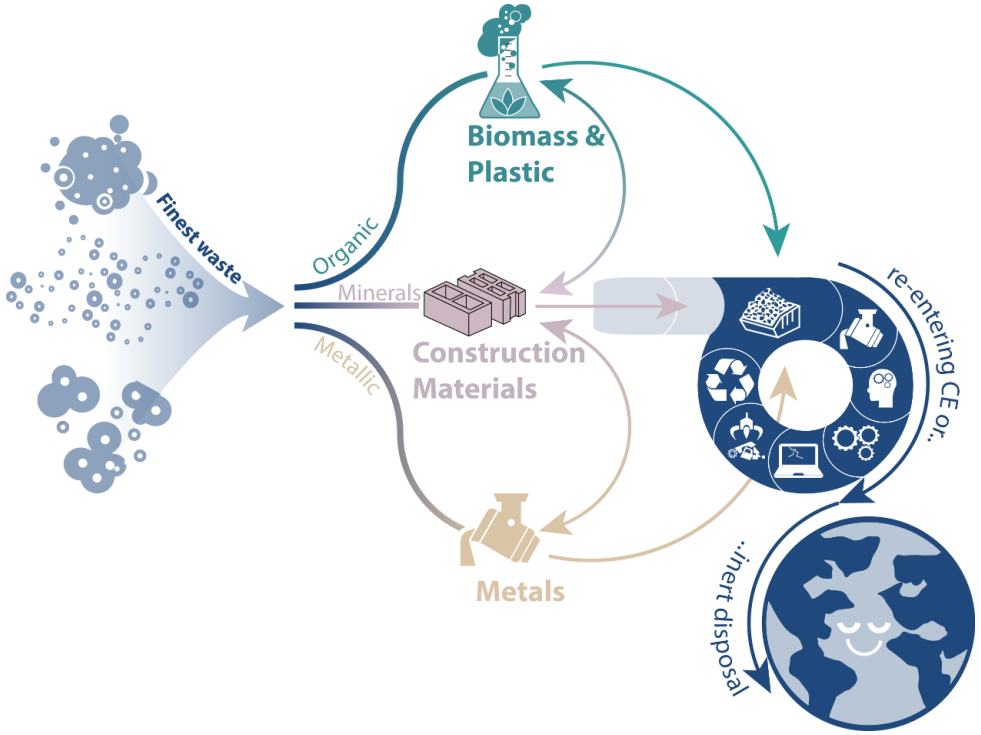
Central research question

FINEST will find sustainable solutions for fine-grained residues from various sources that are currently only disposed of and not utilized

FINEST Approach

Through cleaning, separation, and blending processes several types of valuables and inert residues will be generated economically viable and ecologically benign.



FINEST Project Structure and Research Program

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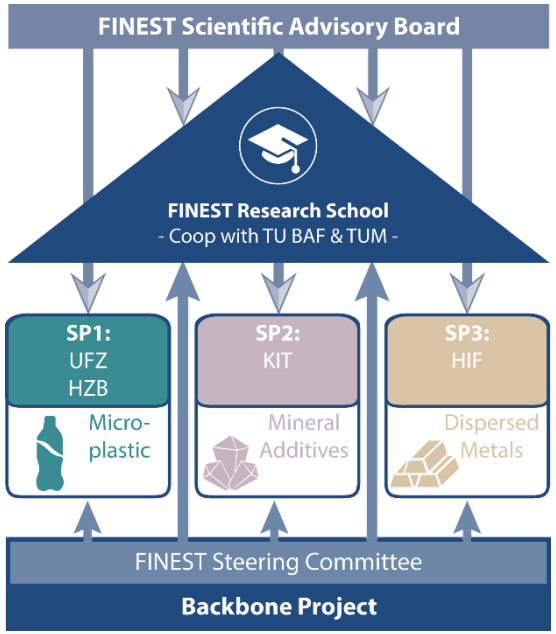
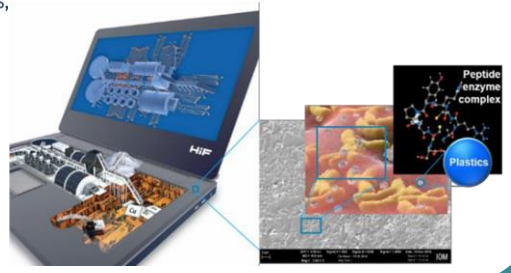


SP1 – FINEST Microplastics

General objective ➞ Bio-based recycling of (micro-) plastic residues

Goals - products:

- **Biocatalysts** to convert plastics fractions to yield
  - specific mono-/oligomers for product synthesis,
  - microbial biomass amenable to further microbial fermentation and
  - inert and safe residues for deposition
- **Anchor peptide arrays** enabling improved accessibility of microplastics for degrader enzymes and separation/detection of plastics
- **Novel thermal sensors** for non-invasive process monitoring



SP2 – FINEST Mineral Additives

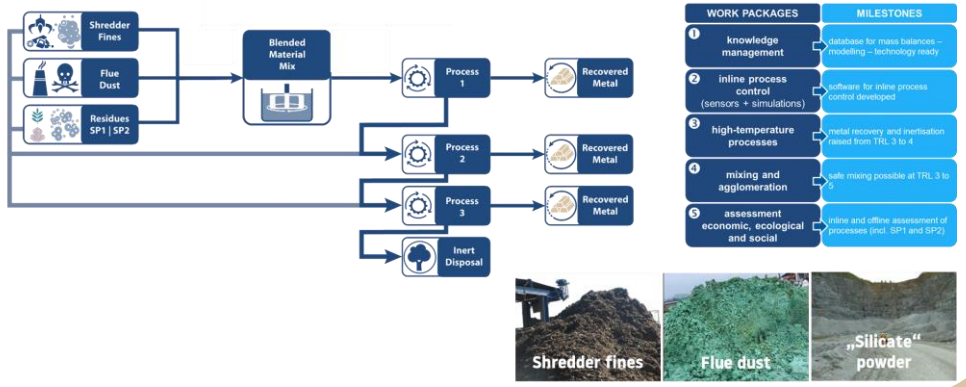
General objective ➞ Recovery of mineral additives during chemical recycling

Goals:

- Mapping & Characterization
- Sensors (process control)
- Monitoring during pyrolysis
- Use in RC-Cement
  - Additive partitioning
  - Effects on products
- LCA for decentralized recycling plants

SP2 – FINEST Disperse Metals

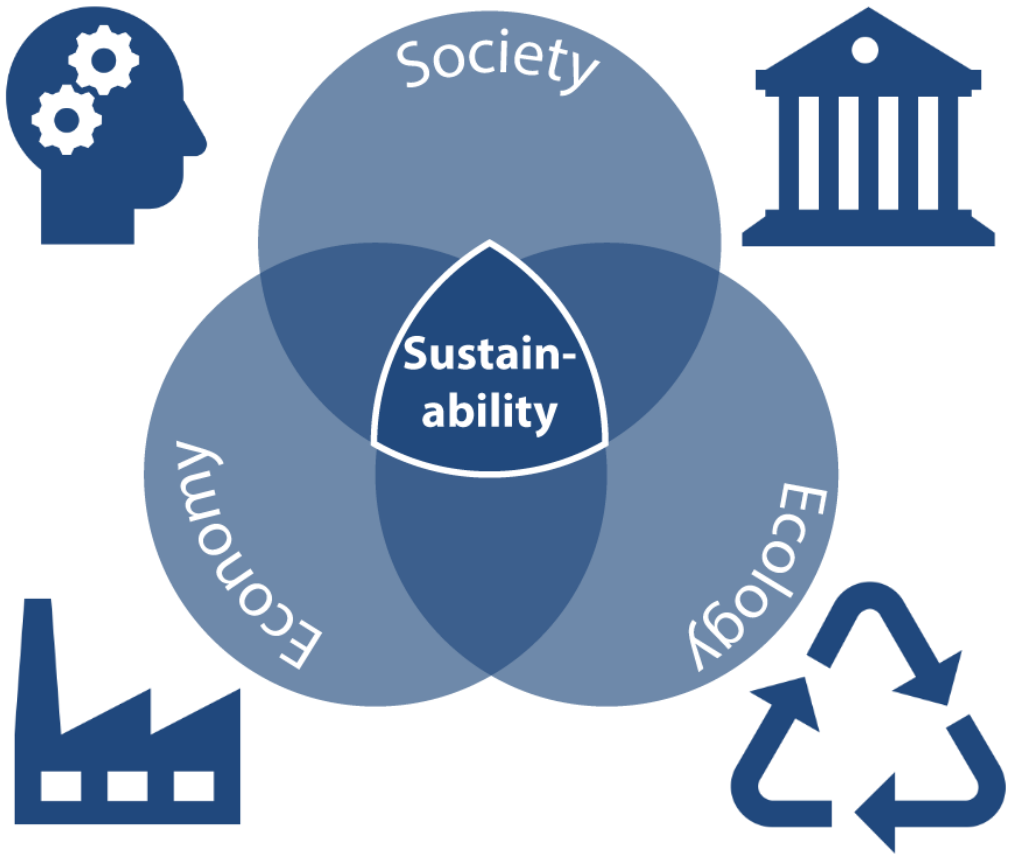
General objective ➞ Blending of complex residues, metal recovery or benign storage



Societal relevance & impact

Impact on education

- Interdisciplinary expertise
  - Resource management
- Life-cycle thinking
- Industrial ecology



Impact on decision-makers

- Adaptation of regulations
- Shift in research funding
- CE thinking in procurement

Impact on industry

- Reduction of waste
- Valorisation of residues
- Knowledge transfer
  - Skilled personnel
- Tech transfer

Impact on ecology

- Resource recovery ⇧
- Materials kept in the loop
- Amount disposed ⇩
- Environmental risks ⇩

The Future is Circular.

This work was performed as part of the project ‘Use and management of **finest** particulate anthropogenic material flows in a sustainable circular economy’ (**FINEST**), which is funded by the Initiative and Networking Fund of the Helmholtz Association (grant agreement number KA2-HSC-10).

Hans Carl von Carlowitz
(1645-1714)