TRENDS AND DEVELOPMENTS IN BUILDING MATERIALS FROM SUSTAINABILITY TO DIGITALISATION

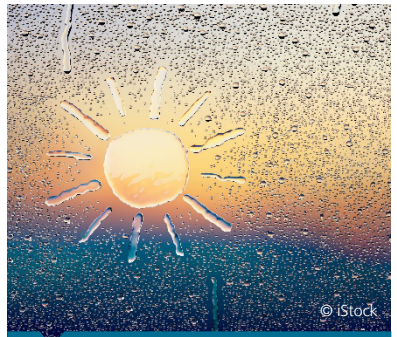
International SAP Conference on Building Materials 2021-04-27 Dr. Sebastian Dittrich

Building on knowledge

ACOUSTICS

ENERGY EFFICIENCY AND INDOOR CLIMATE

LIFE CYCLE ENGINEERING



HYGROTHERMICS

INORGANIC MATERIALS AND RECYCLING

ENVIRONMENT, HYGIENE AND SENSOR TECHNOLOGY

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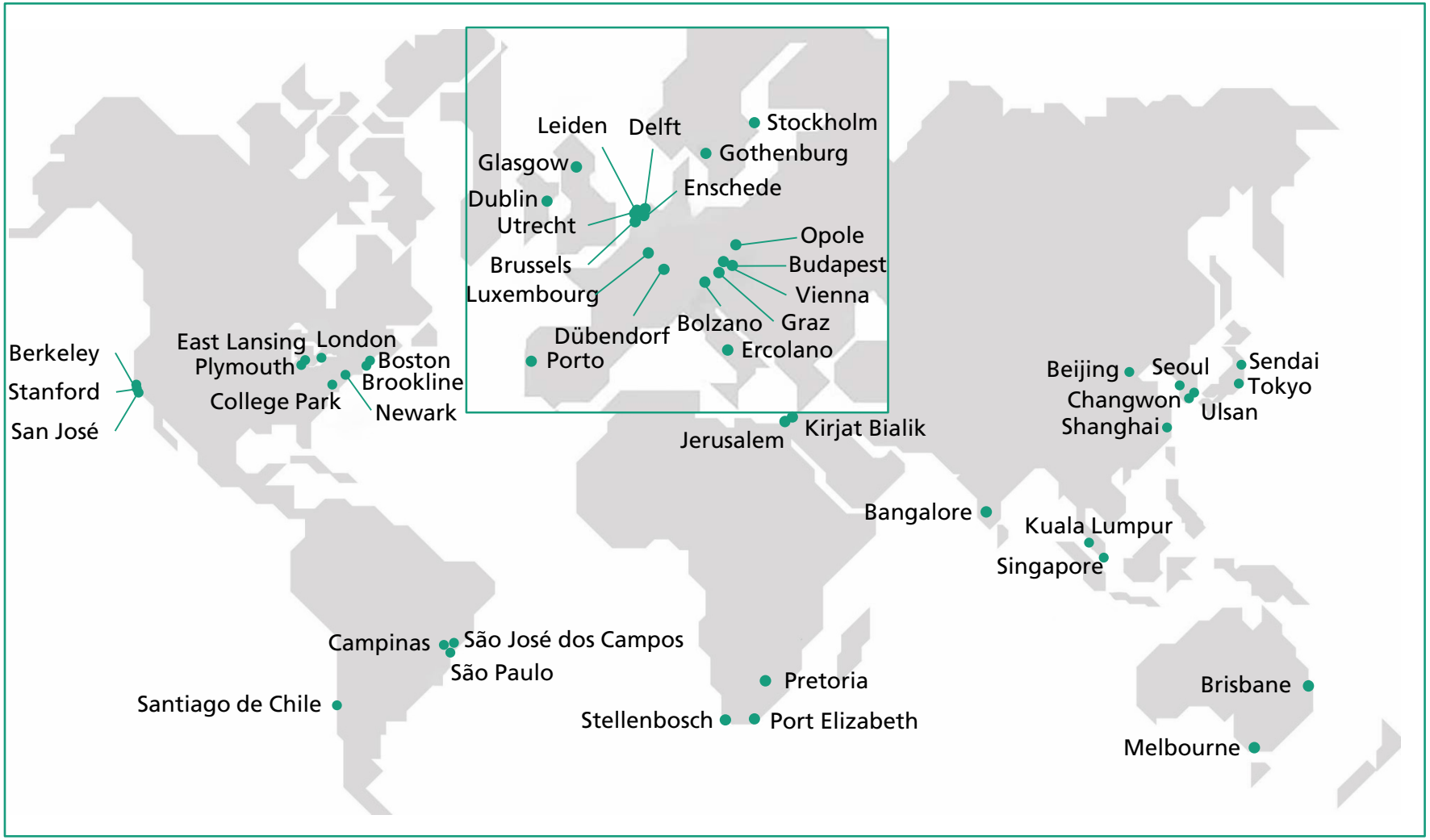
The Fraunhofer Gesellschaft - International Network

- 8 independent Fraunhofer affiliates
- Active with partners in approximately 80 countries
- Representative Offices and Senior Advisors worldwide leverage networks abroad



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Fraunhofer IBP

The Fraunhofer-Gesellschaft
Locations in Germany

- 74 institutes and research units
- 28,000 staff
- € 2.8 bn research volume

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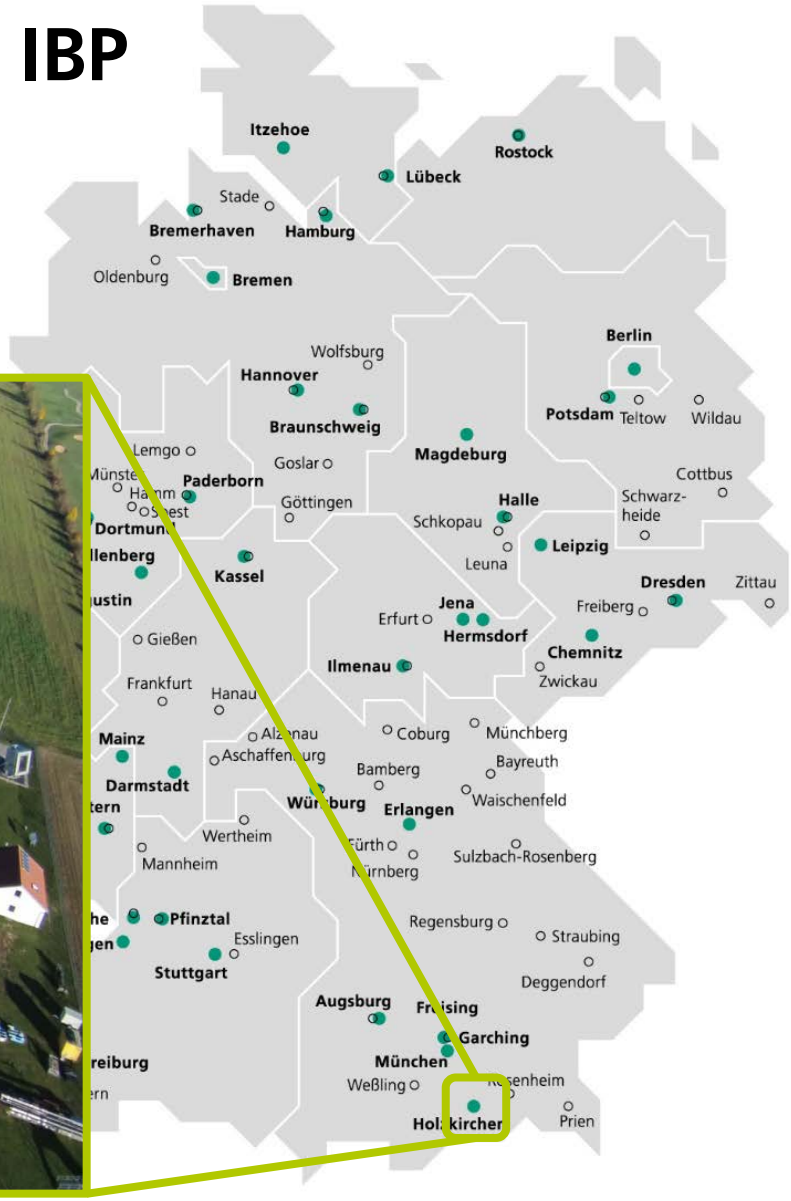
Fraunhofer IBP

The Fraunhofer Institute for Building Physics IBP

- Headquarter in Stuttgart, Branch **Holzkirchen**
- 270 staff
- € 30 m research volume



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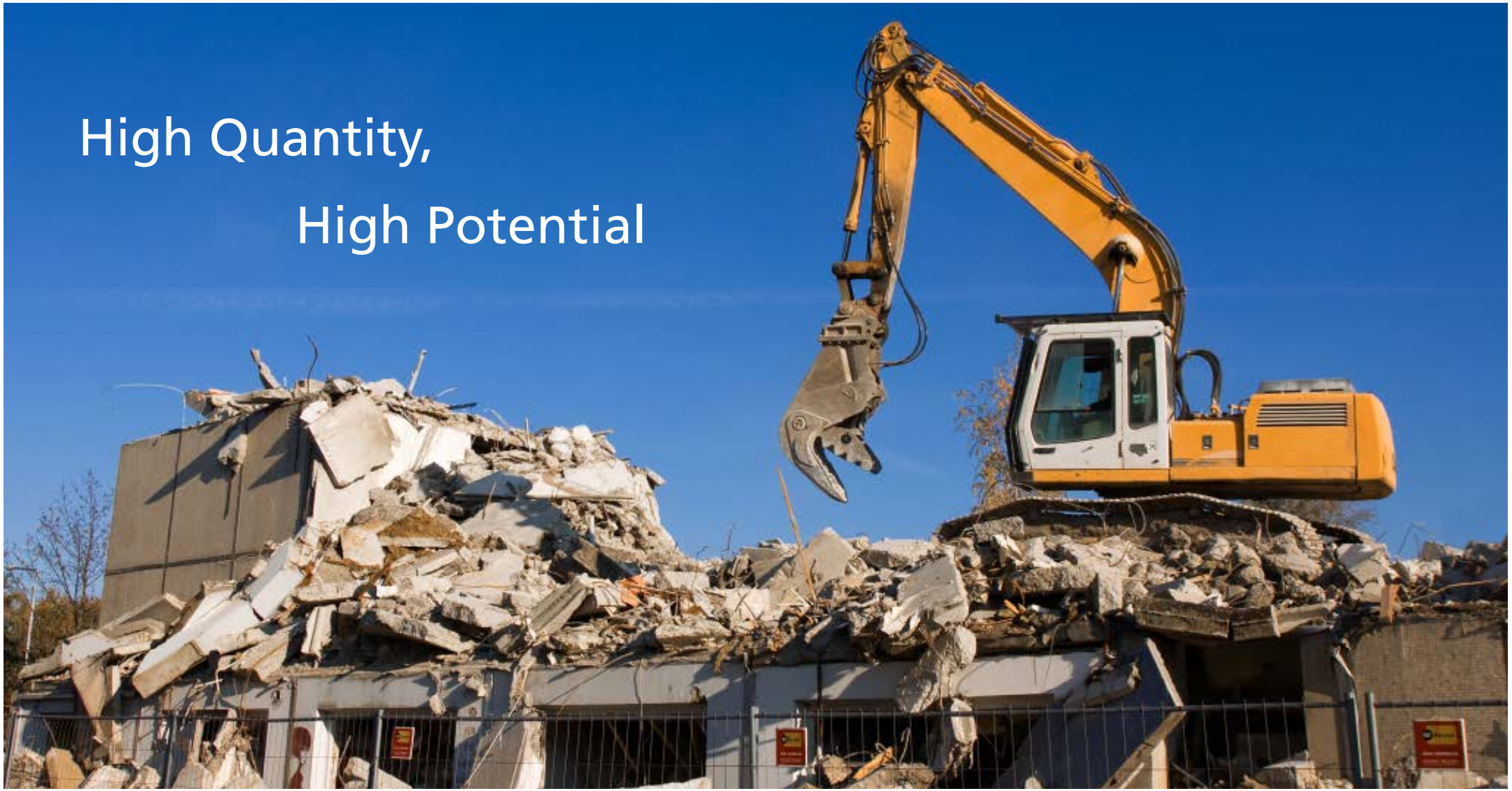
Raw materials are not infinite!

We are living on tick!

Construction & Demolition Waste



What about Urban Mining?

Annual need of mineral raw materials of about 500 Million tons

About 28 billion tons „stored“ in infrastructure and buildings

2 Objections on the way to „Realcycling“!

„Quality of RC-Material cannot compete with primary raw material“

„Heterogeneity prevents high quality recycling “

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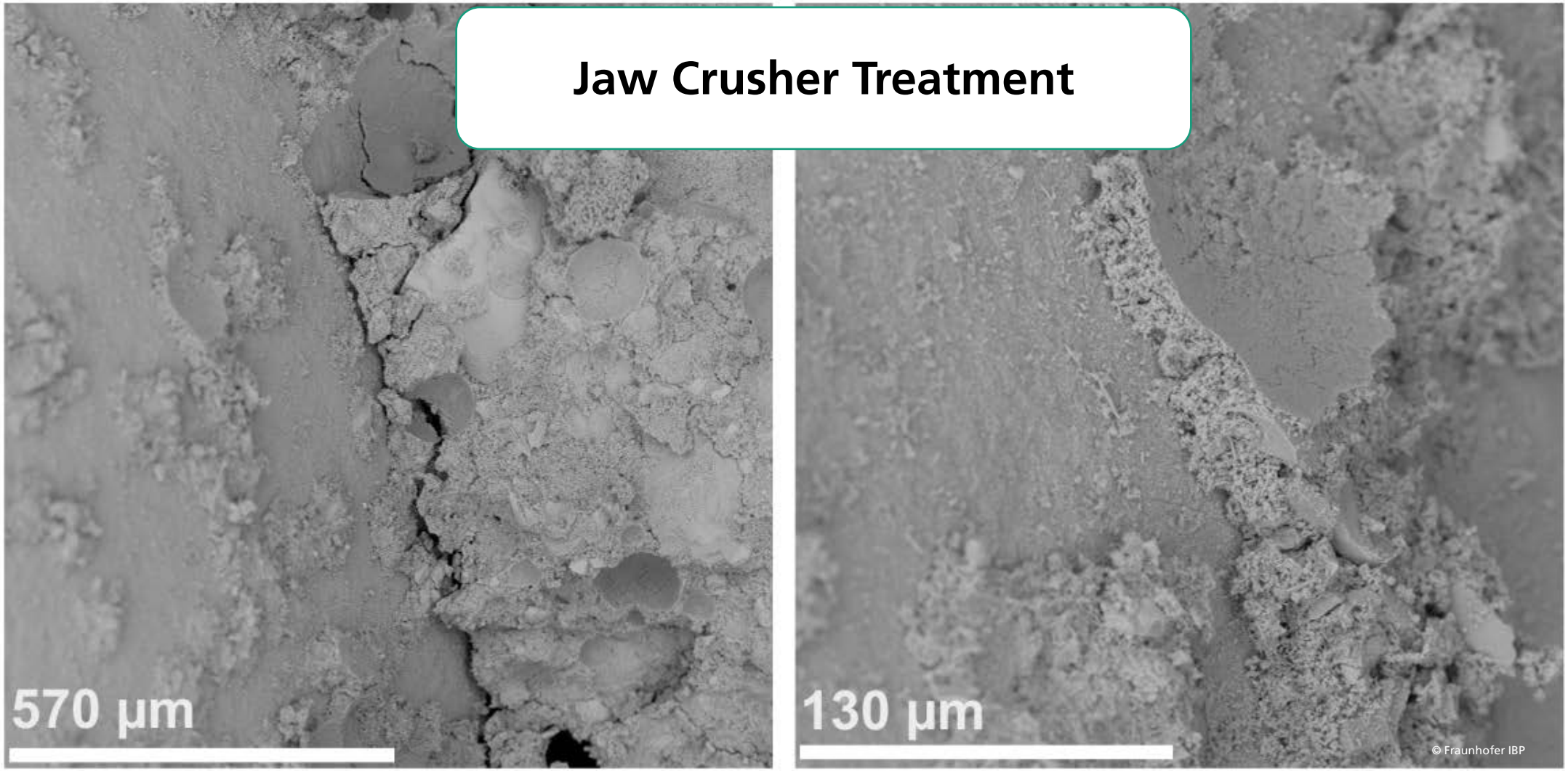
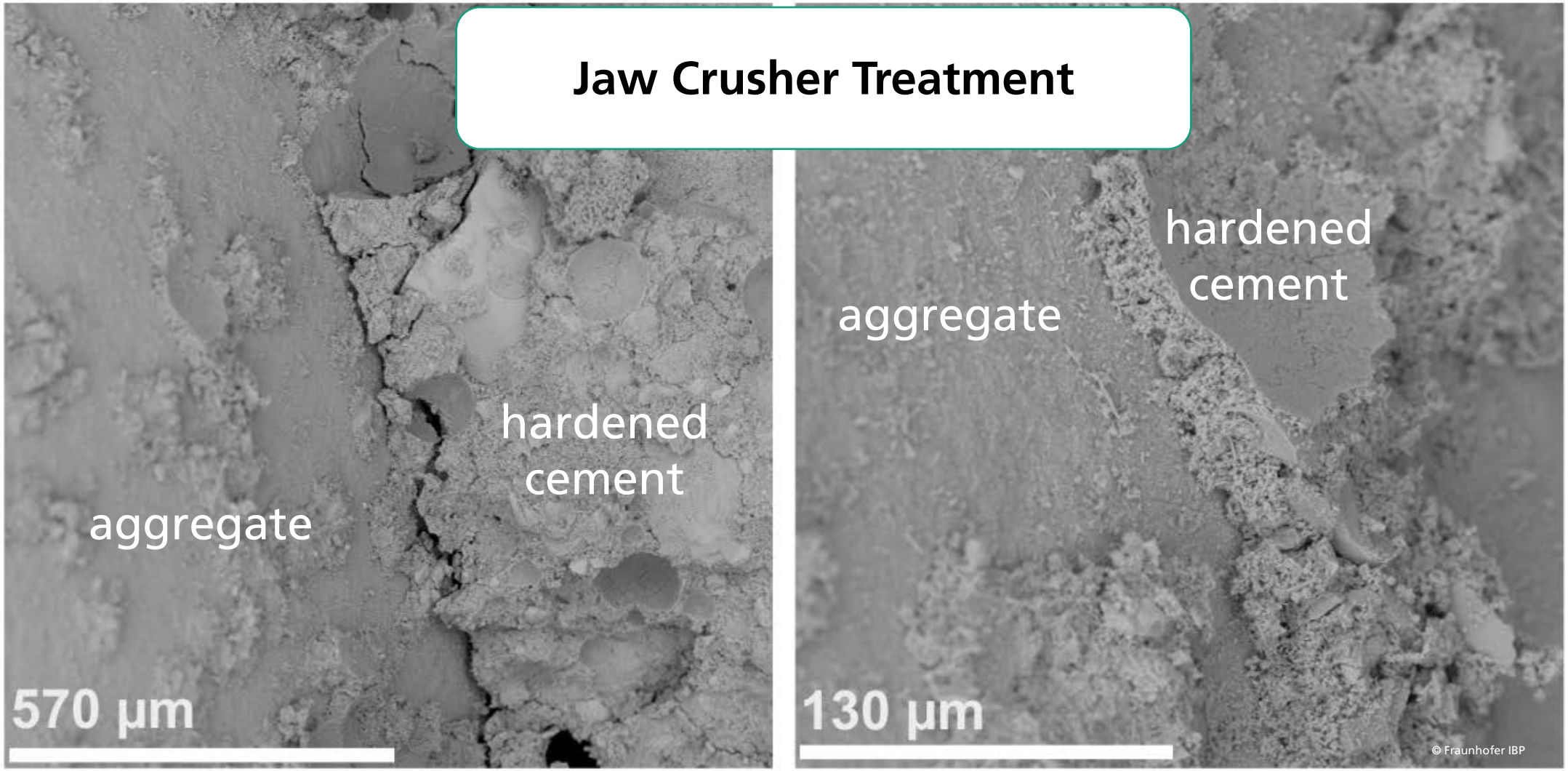
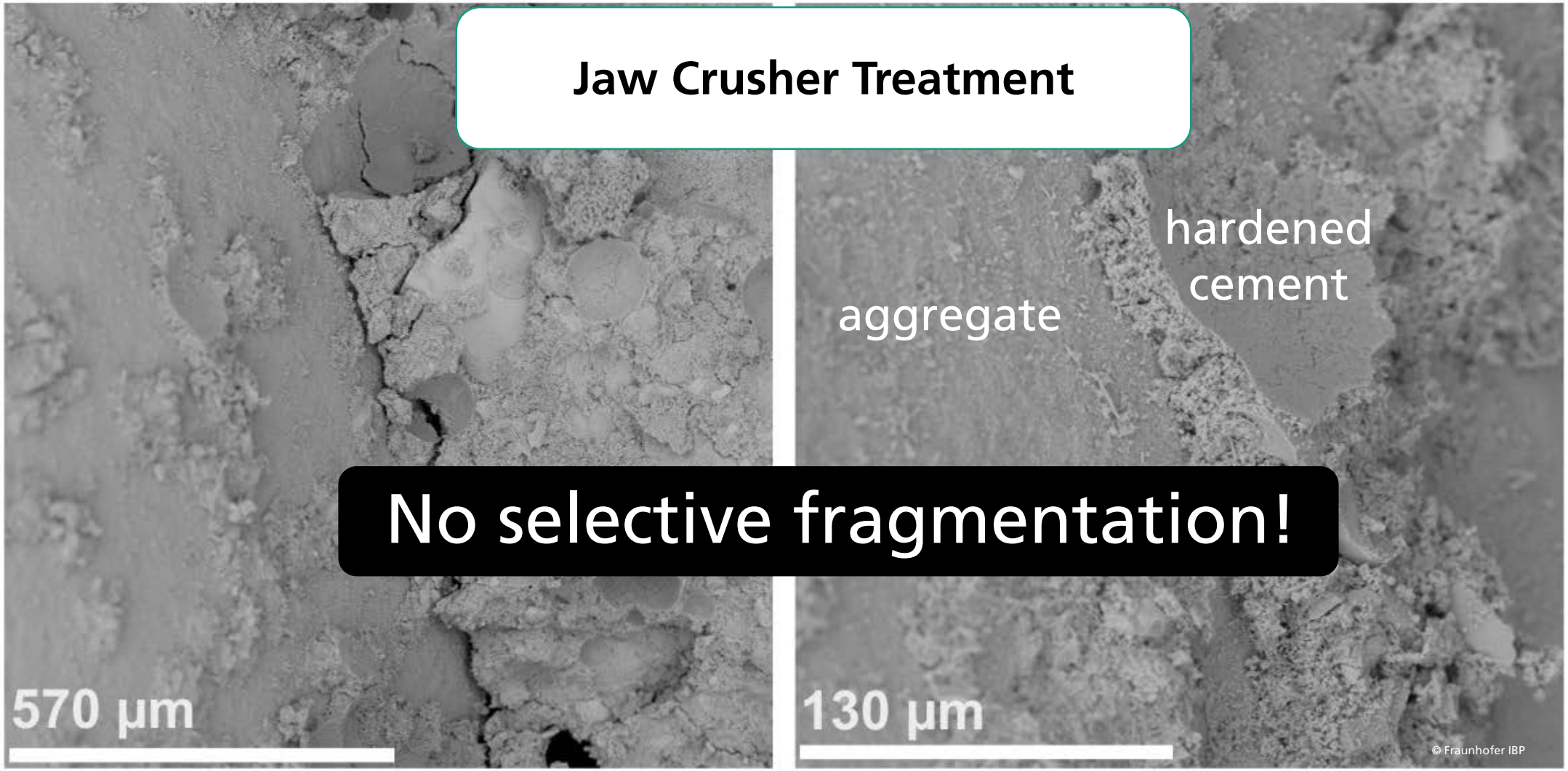
Mechanical Treatment



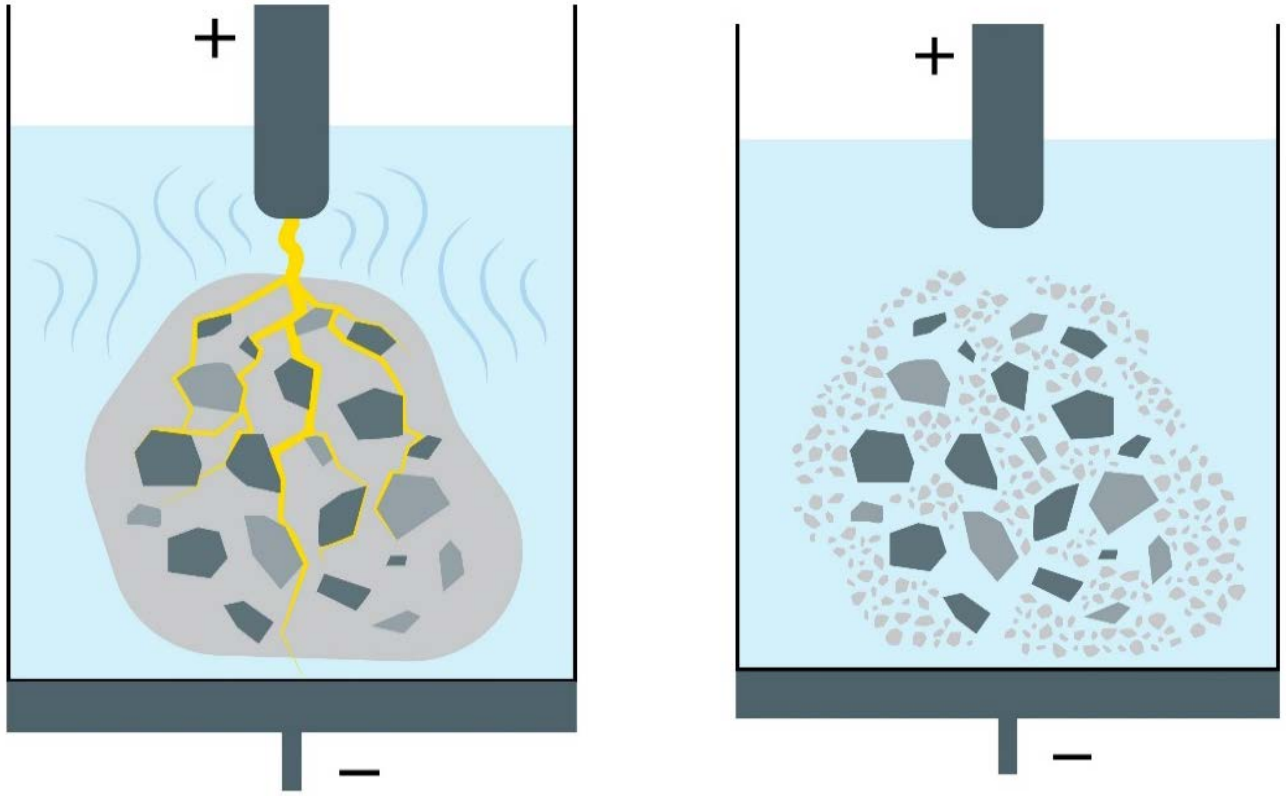
Mechanical Treatment



Mechanical Treatment

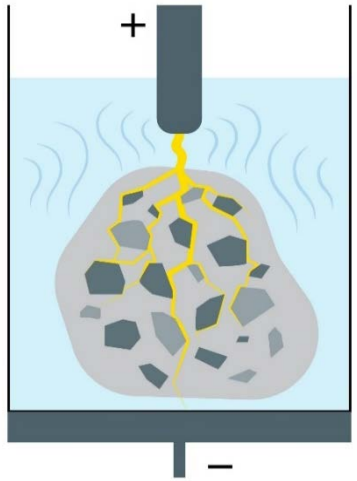


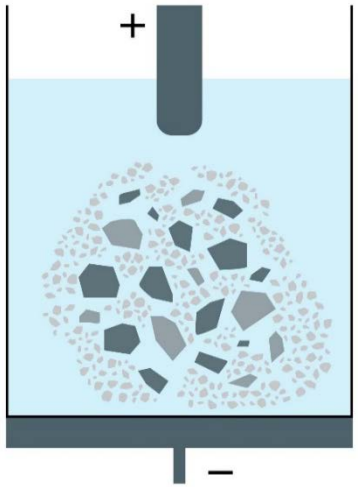
Pulsed Power Processing – Electrodynamic Fragmentation



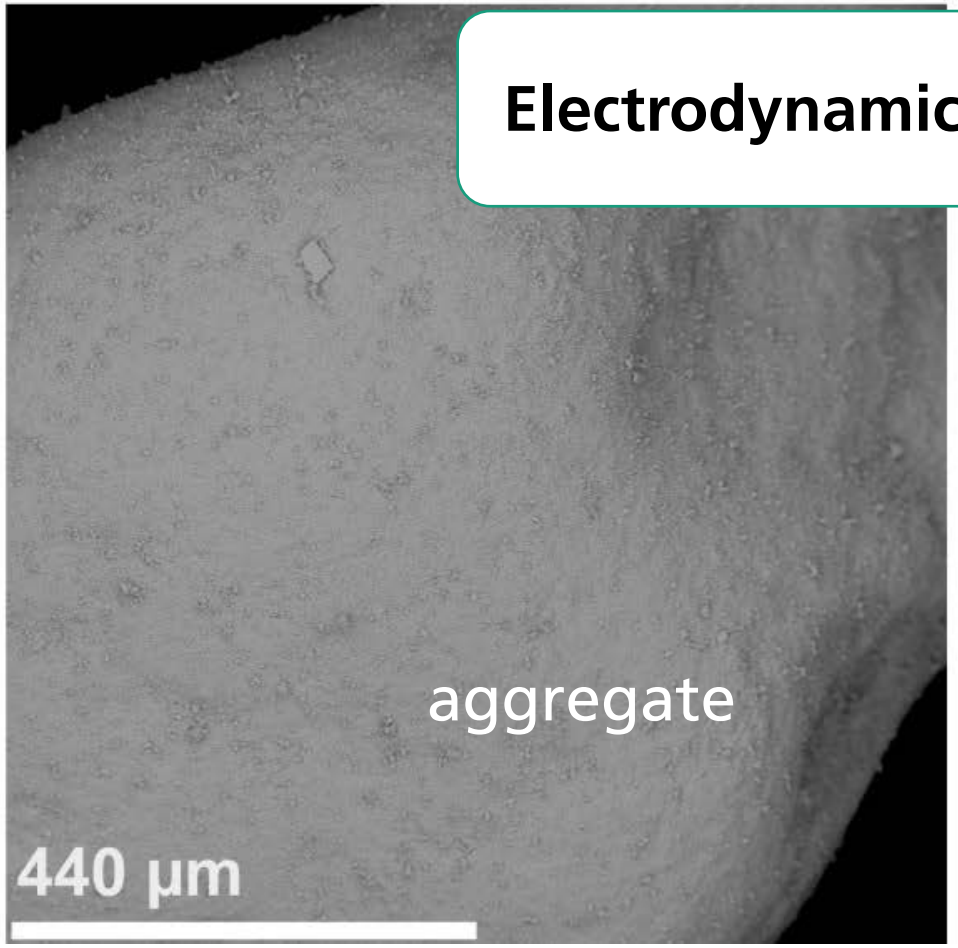
- Treatment with pulsed high voltage discharges
- Discharge “follows” grain/phase boundaries
- Wet process -> no dust
- Labscale process
- Scale-Up in progress
  - Investors needed -> Interested?

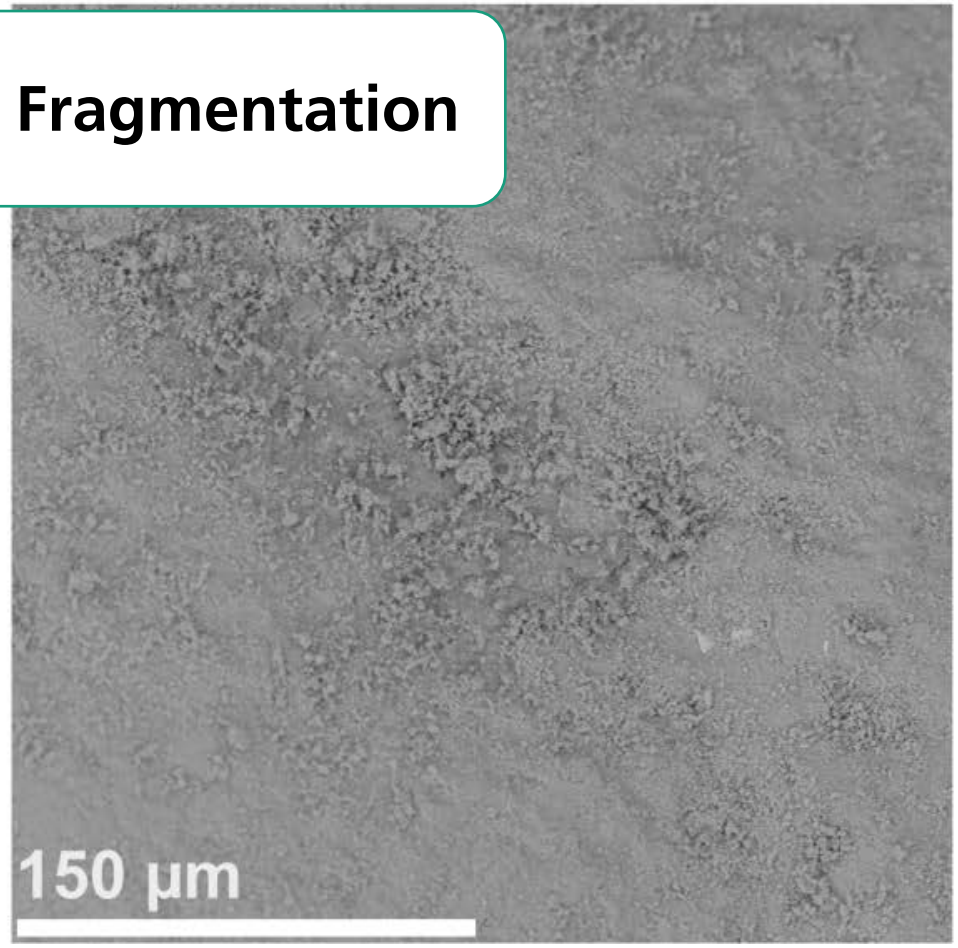
Pulsed Power Processing – Electrodynamic Fragmentation





Electrodynamic Fragmentation





Competitive Quality of RC material!

coarse fraction / aggregates

middle fraction / sand

fine fraction / hardened cement

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„Heterogeneity prevents high quality recycling!“

„Purity of variety is the key!“

Challenge:

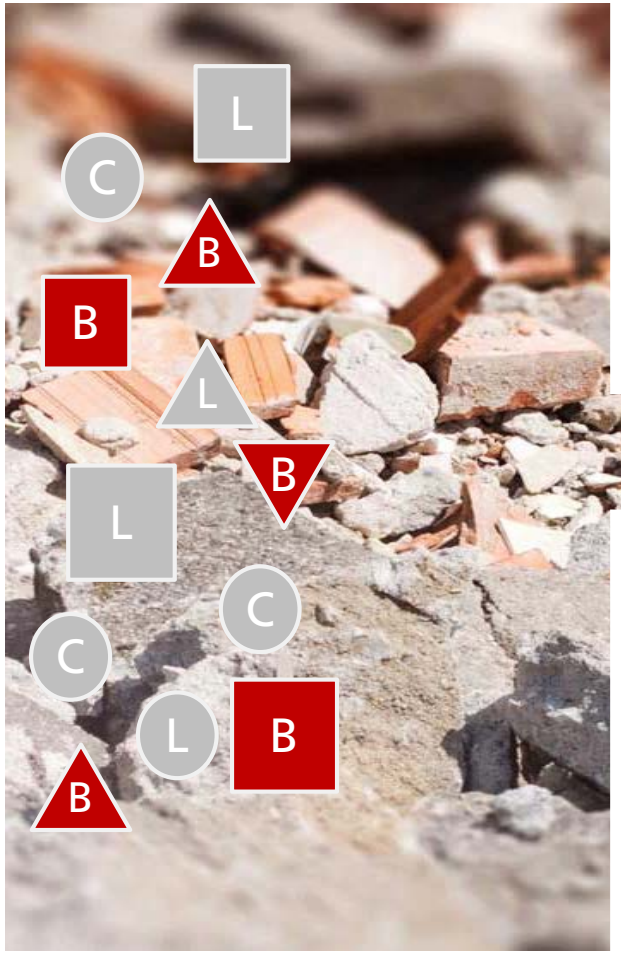
Sorting of major components!

L Sand-Lime Brick

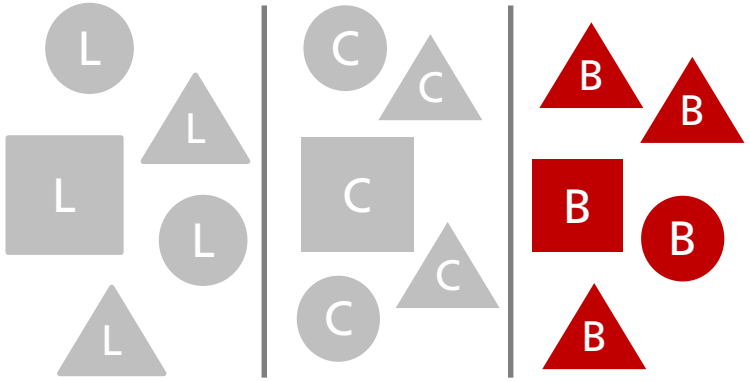
C Concrete

B Brick

„Purity of variety is the key!“



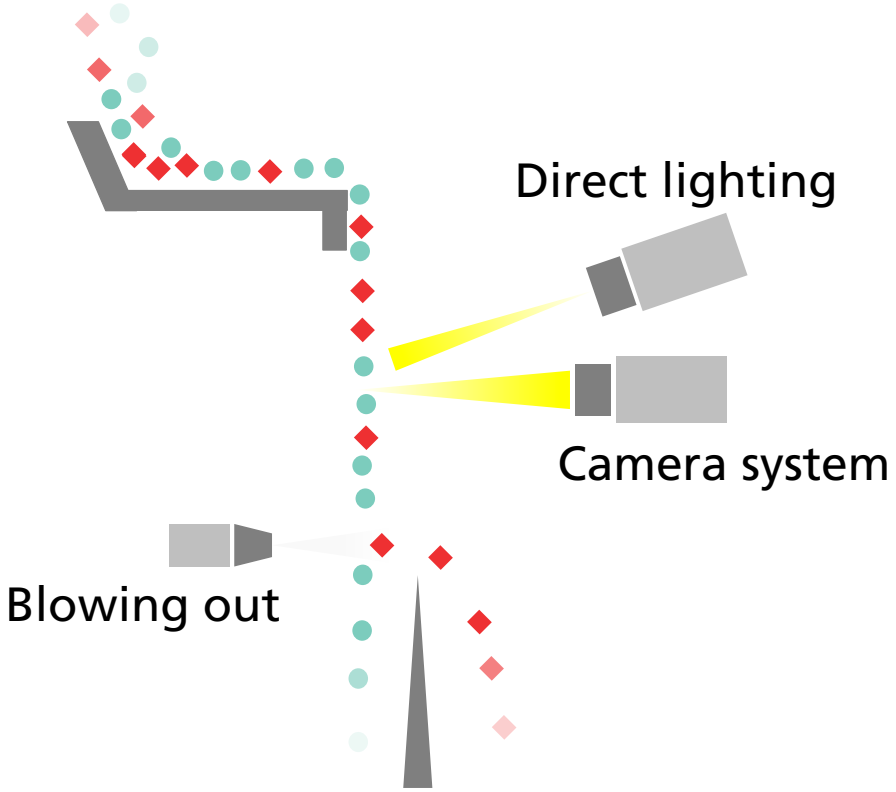
BauCycle-Sorting



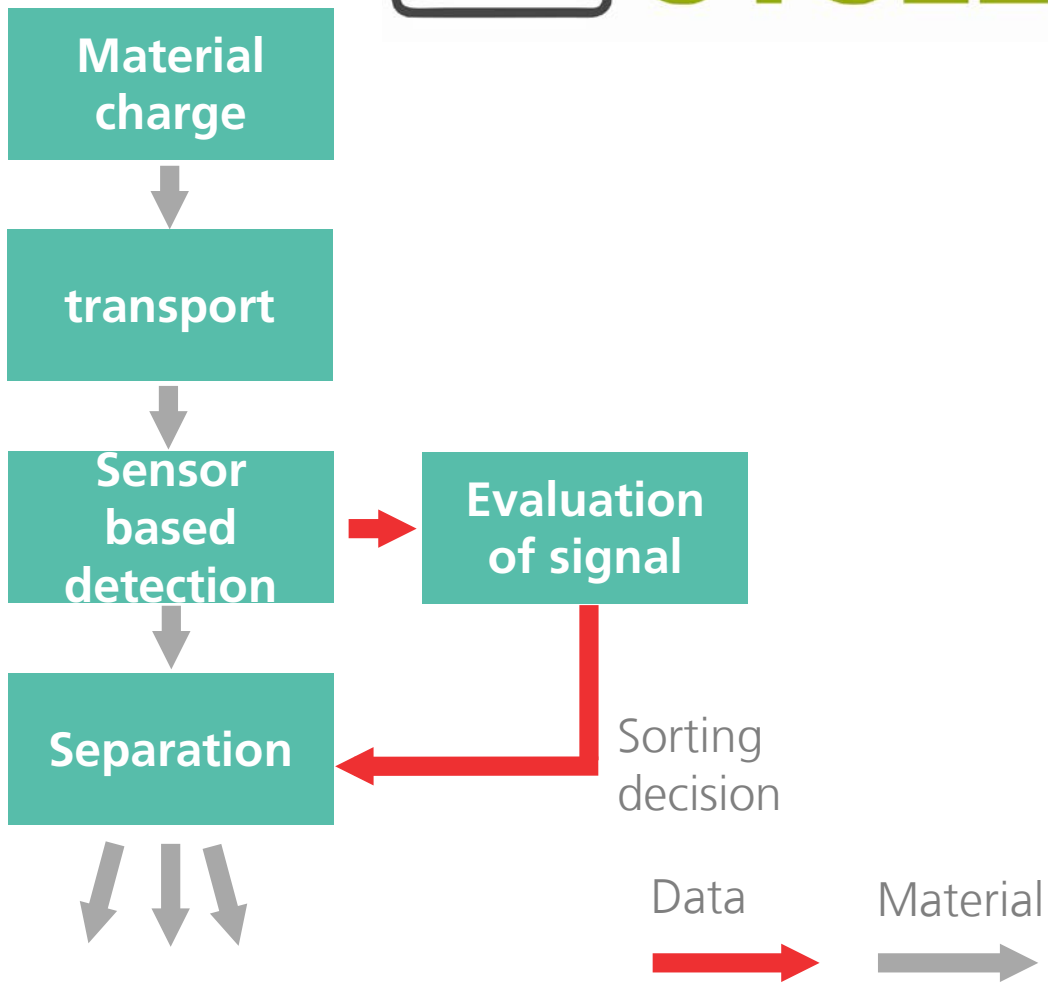
Sorting due to chemical composition of **building materials**

L Sand-Lime Brick **C** Concrete **B** Brick

BauCycle Sorting Setup



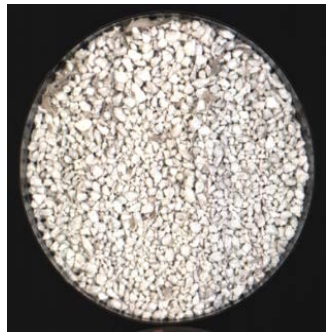
Freefall-Setup



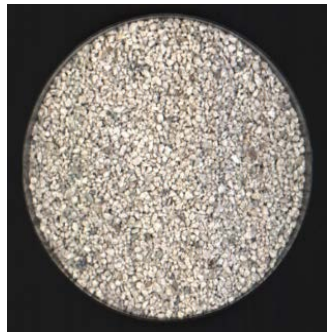
Chemistry based separation

concrete

gypsum #1



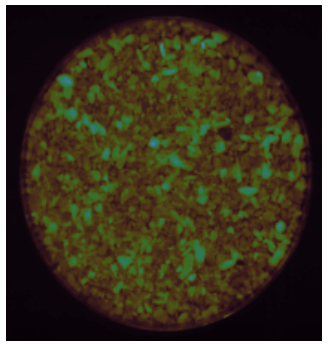
gypsum #2

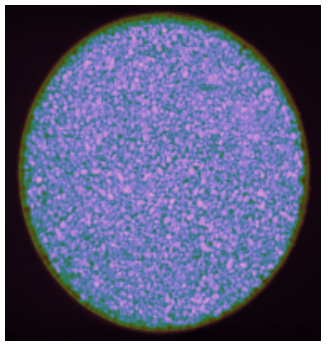


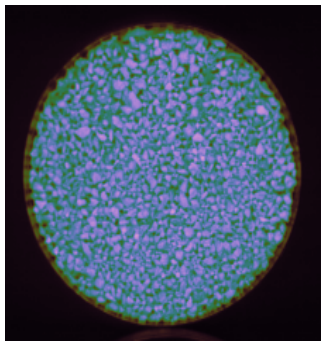
sand-lime brick

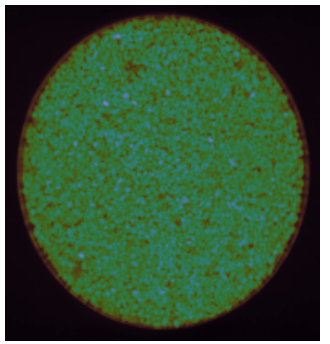
brick #1

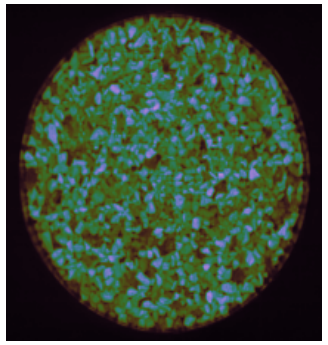
brick #2

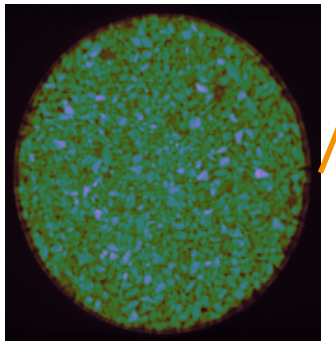












By Near-Infrared Fingerprints concrete, gypsum and sand-lime brick can be distinguished as well.

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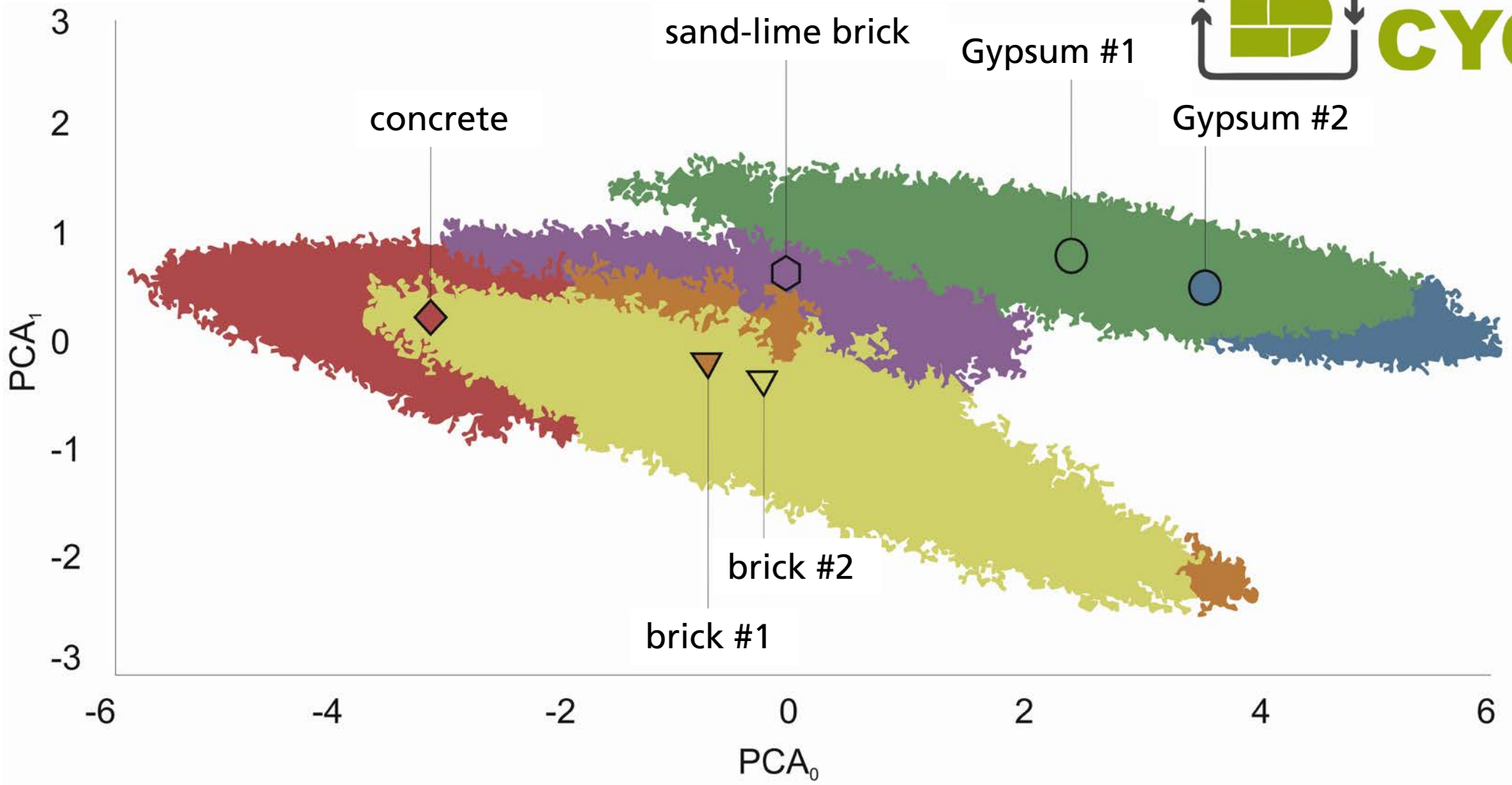
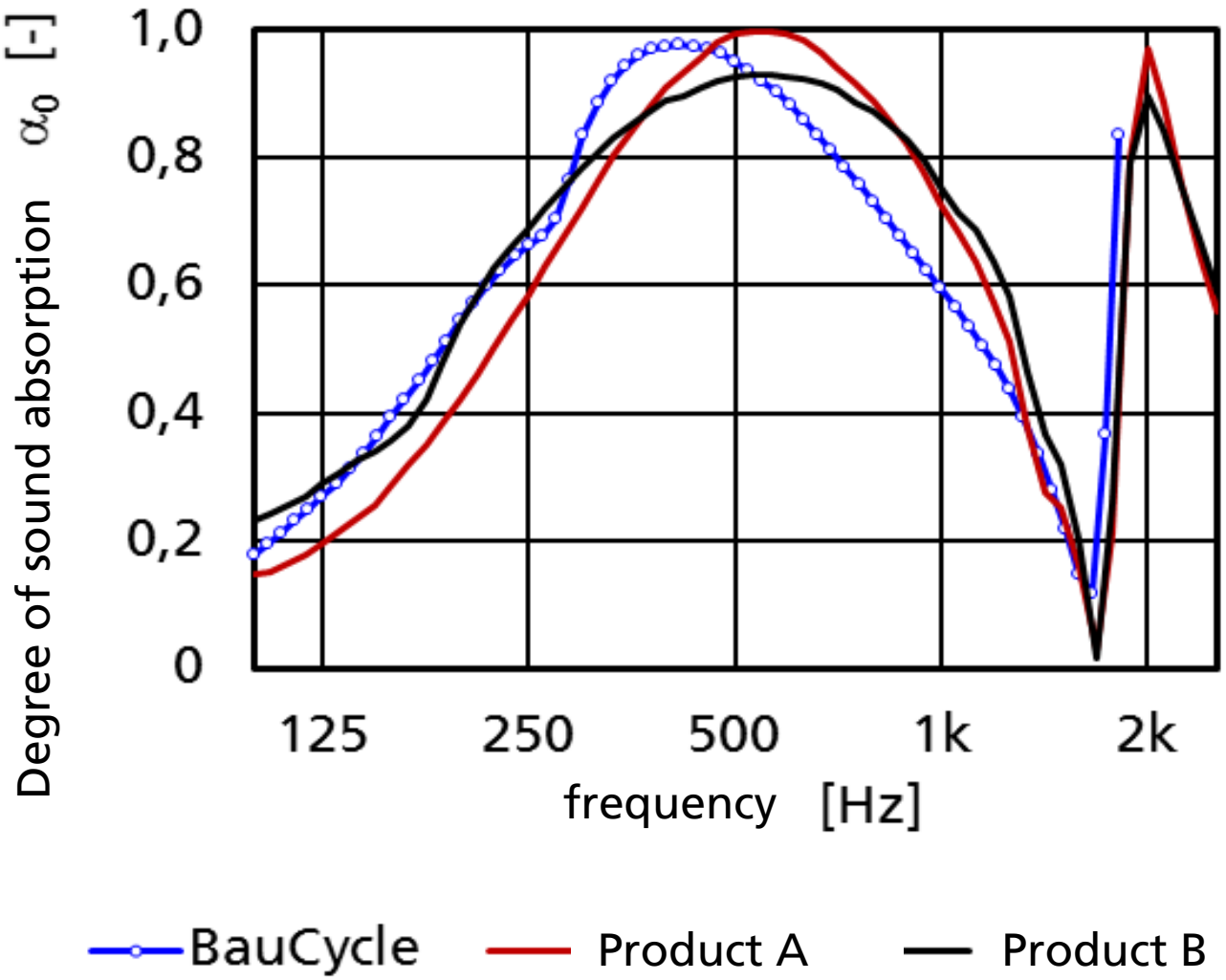
Sorting trial – scatter plot



Sound absorbing plaster from sorted material



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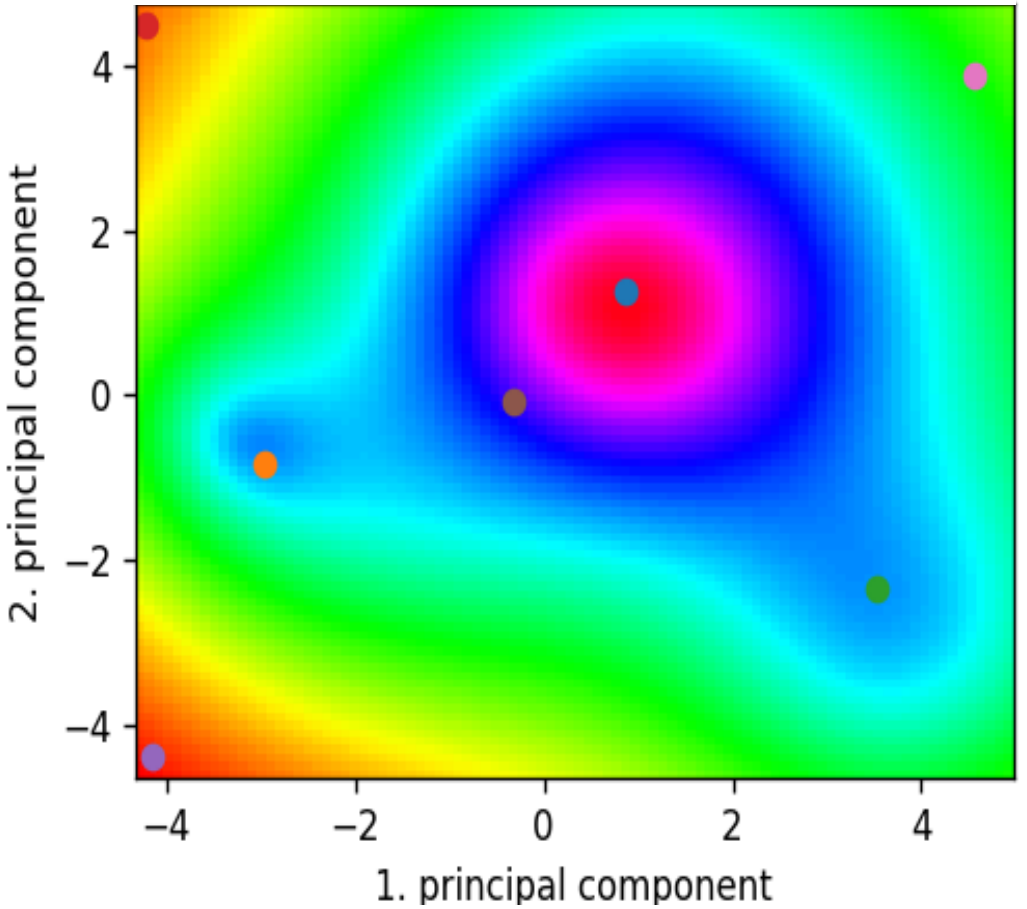
What´s next?

Forecast of building material properties - Ongoing Research

Development/Validation of a data-driven model for inverse design of mechanical properties, costs, sustainability

enables → Optimization of recipes

e.g. Compressive strength



In a nutshell - Ways to get the puzzle solved!

- There´s only one earth with limited ressources!
- Electrodynamic Fragmentation can provide selective separation of materials
- Sorting down to a grain size of 2 millimeter using material fingerprints
- Digitalisation is one consistent next step to a sustainable future in the building industry

THANK YOU FOR THE ATTENTION!

Fraunhofer
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