WE CAN
DO SO
MUCH
TOGETHER

How will new technologies affect end of life of materials?

Innovative solutions for an efficient recycling and recovery of valuable raw materials from C&DW

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Main challenges and keys for moving forward

- ✓ Lack of digitalization along the value chain.
- ✓ Need for higher purity levels of recycled fractions.
- ✓ Cleaner manufacturing processes and more efficient construction products.
- ✓ Scarce design for the circularity of the building products.
- ✓ Need to adapt policies, standards and business models in order to stimulate demand and create competitive markets.

Is technology the key?

BIM-BASED TOOLS FOR SELECTIVE DEMOLITION
HISER BIM Smart Demolition

CURRENT STATUS

Information for demolition projects:

- Old plans, often from design/construction stage and never updated
- Photos, without quantitative information
- Manual measurements, etc.

- ➢ Expensive in time and resources.
- ➢ Inaccurate - Deviations up to 400%.
- ➢ Poor planning and management.
- ➢ Lack of digitalization, etc.

NEW HISER BIM SD TOOL SERVICIO DE LA DEMOLICIÓN SELECTIVA

NEW TOOLS

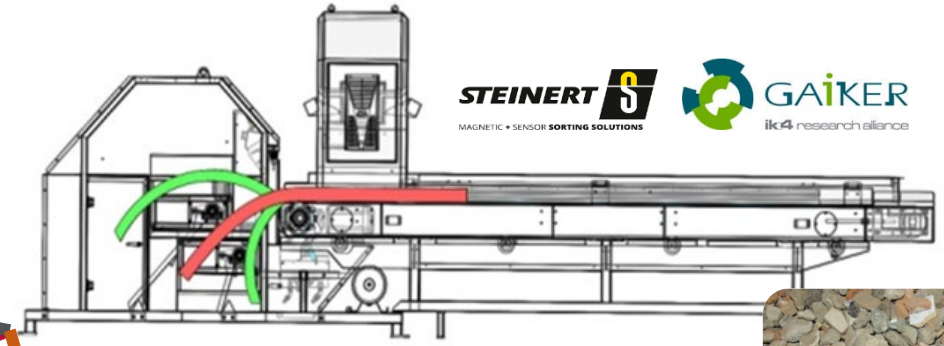
- ➢ Automated audits and CDW inventory.
- ➢ BIM-SD tool increases the accuracy of demolition (and refurbishment) waste materials prediction (deviation <20%).
- ➢ Waste planning and management.
- ➢ Digitalized process→ improved traceability

ADVANCED SORTING TECHNOLOGIES

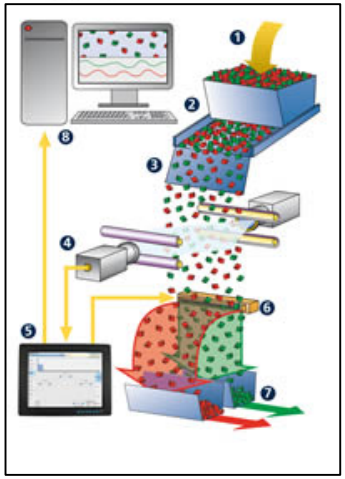
➢ Sensor-based sorting solutions:

Processing and optical sorting of mixed CDW based on the difference of colors and form. Technology based on hyperspectral image analysis (HSI) in real time.

Grey fraction (mortar, concrete, stone)



Performance >90%



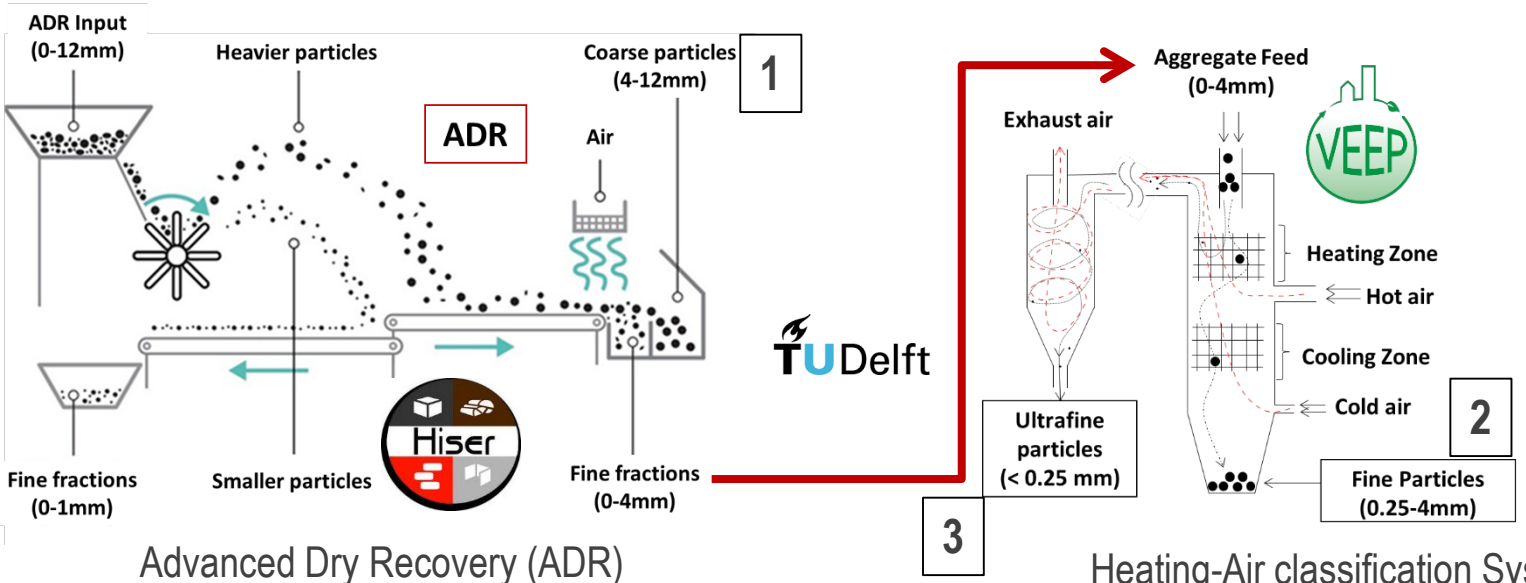
Mixed CDW 6-50mm

Red fraction (bricks, tiles, ceramics, etc.)

Rejection fraction (plastics, woods, metals ...)

ADVANCED TECHNOLOGIES FOR THE RELEASE AND IMPROVEMENT OF CONCRETE WASTES

➢ Release and improvement through ADR combined with HAS:



Advanced Dry Recovery (ADR)
Release of fine fractions 0-4 from wet coarse concrete wastes
Use of kinetic energy to break the bonds formed by moisture.

Fluidized bed reactors

Heating-Air classification System (HAS)
Separation and thermal-mechanical treatment of wet and contaminated 0-4 mm fraction
Heating of the 0-4 mm and milling to concentrate more cement into the 0-0,125 mm fraction

Obtained products :

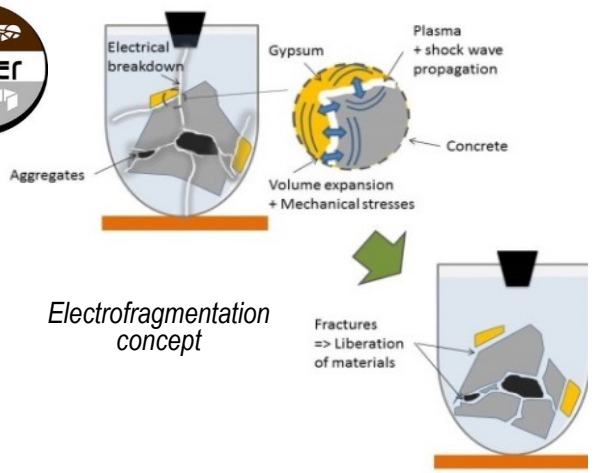
- **High quality coarse aggregate (> 4 mm), reduced impurities and water absorption <5%**
- **High quality fine aggregate (0-4 mm), dry aggregates with water absorption <5%**
- **Ultra-fine particles highly concentrated in cement (<0,125 mm)**

OTHER ADVANCED TECHNOLOGIES

➢ Electric-pulse fragmentation (EPF) :

EPF involves generating highly energetic electrical pulses (150 - 750 J/pulse) with a very fast voltage ramp-up time (<500 ns) and applying them to materials immersed in water.

Tech. and eco. validated for UHPFRC recycling.

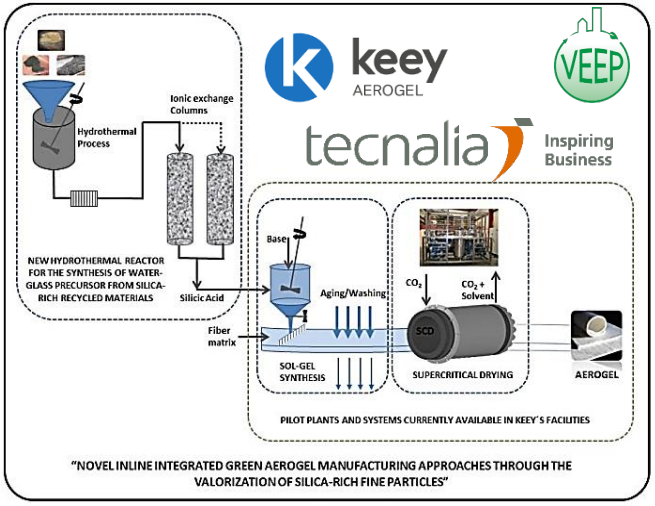


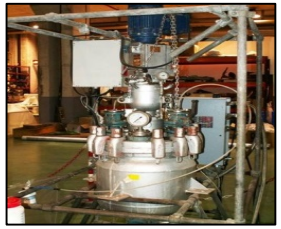
Electrofragmentation concept

(a) 0/2 mm

(b) 2/5 mm

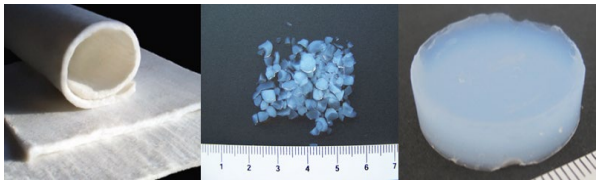
➢ Cost effective silica based aerogels synthesized with CDW





SICLA: Aerogels synthesis technology

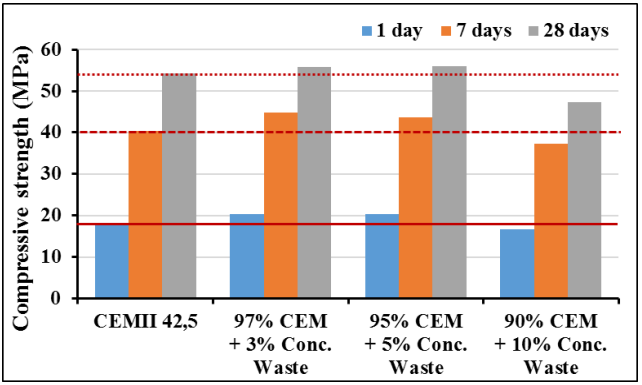
- Combination of hydrothermal technology, ion exchange, sol-gel and supercritical drying at low temperature that allows to value RCD with high silica contents (> 50% wt).
- Reduction of production costs in more than 40%.

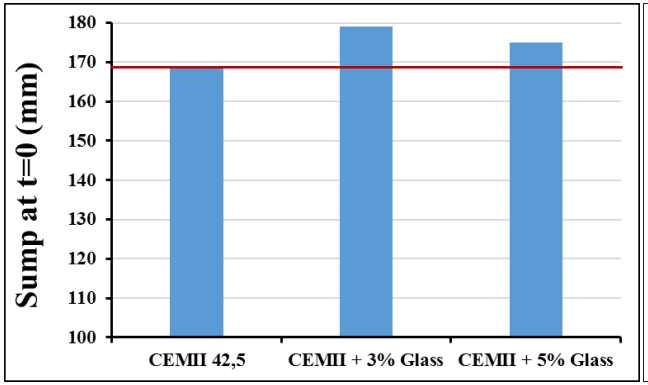


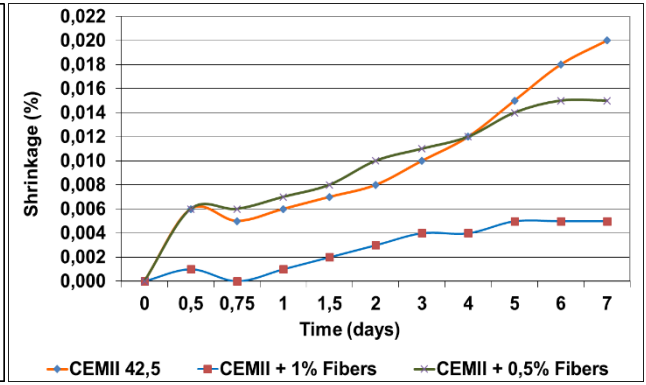
- ✓ **Low thermal conductivity λ<0.018 W/mK.**
- ✓ **Ultra light weight solids.**
- ✓ **They can be synthesized from CDW.**

GREEN CEMENTS AND CONCRETES

➢ New green cement with recycled admixtures (improved properties):

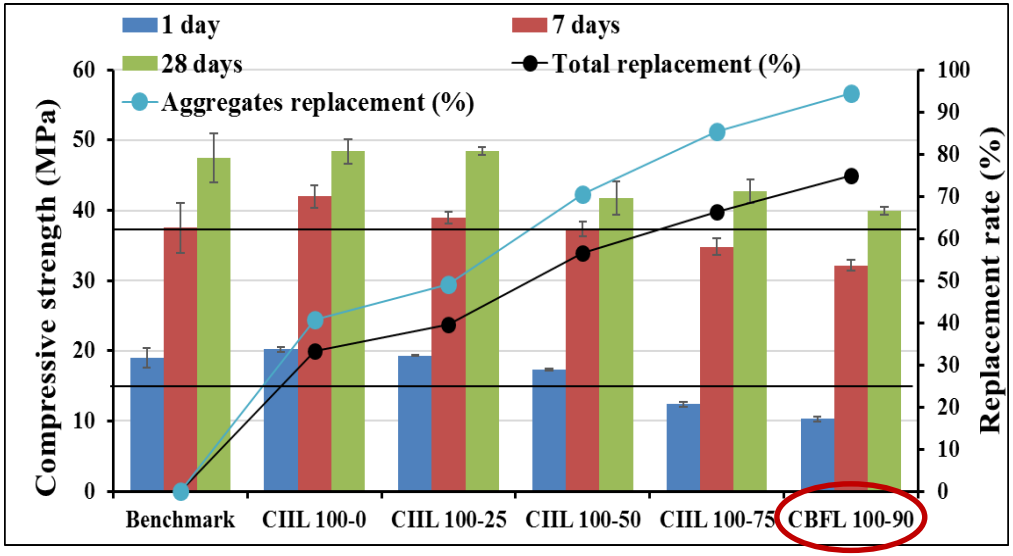






Proposal to the prEN197-1 → To include recycled concrete waste as a new minor additional constituent (5%)

➢ Concretes with up to 95% of recycled aggregates and green cement:



VEEP

- 40 MPa
- 95% recycled aggregates
- 75% wt of recycled materials
- Max. water penetration = 25mm
- Mean water penetration = 10mm

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GREEN CEMENTS AND CONCRETES

Low carbon and energy embodied cement and concrete:

Recycled Glass

+

Laddle Slags

+

Ceramic waste

+

CEM I-42.5R

→

New Eco-cement BLENDED

SRMs → up to 12%

FISSAC

+

EAF slags

Green Concrete

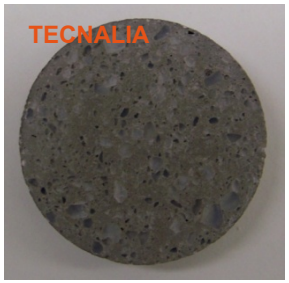
160m² Pilot

> 1500kg slags / 1m³

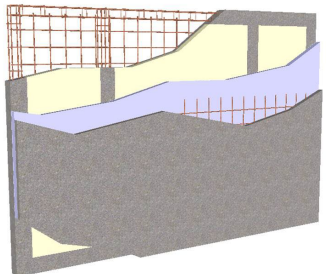
GREEN ENERGY-EFFICIENT PRODUCTS: AEROGELS

➢ Thermal mortars

- → Aerogels in granule format
- → Thermal conductivity λ <0,05 W/mK
- → Ultra light-weight (σ <1.000 kg/m3)



CESAR Project, "Plan nacional del Ministerio de Economia y Competitividad, España 2015-2018"



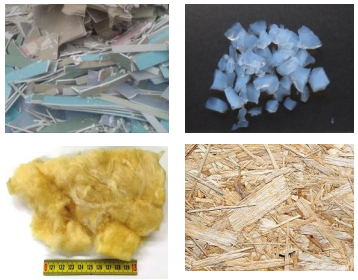
➢ Precast concrete elements

- → Concrete with 75% by wt of CDW
- → Aerogeles blankets replacing EPS
- → Transmittance U<0,17 W/m2K
- → Eco-designed for their reuse

VEEP

➢ Plasterboards

- Panels with wood fibers, aerogels, mineral wool for improved thermal performances.
- Recycled gypsum;



Hiser

- Up to 30% of recycled gypsum
- λ<0.076W/mK
- Improved fire resistance

➢ Wood-Polymer Composites:

- Including recovered CDW wood and rockwool

Hiser

- Improved mechanical performance
- Cost efficient
- Recycled content up to 68%

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THANK YOU FOR YOUR ATTENTION