



**Support of companies designing
innovating geopolymer materials
dedicated to construction with a
technical, standard and field-related
approach**

Vincent CLAUDE

Geopolymer camp, St-Quentin, France, 2024

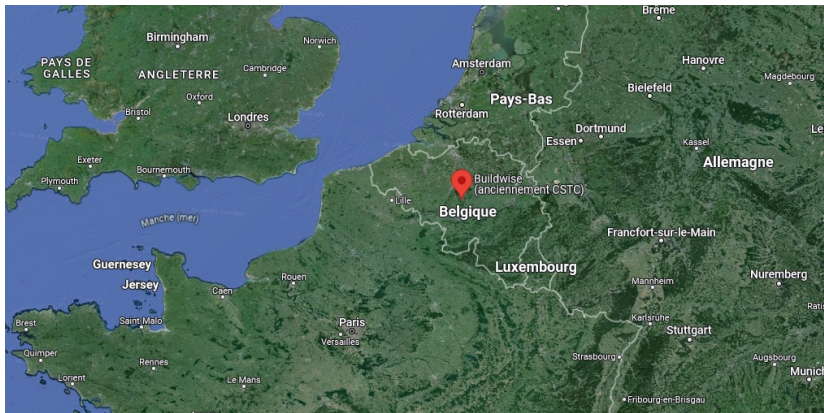
Our company

Our company

- **Belgian contractors** are our members (~100 000 members)



- ~300 workers
- Located near Brussels, Belgium



➤ Inform

Articles and technical guides.
Creation of Belgian and European standards



➤ Research

Mechanical resistance, durability, ecological impact (LCA), acoustic, chemistry, digitalization ...



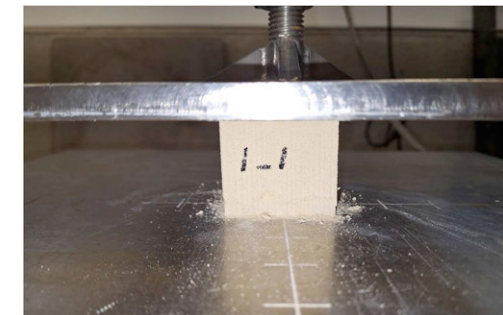
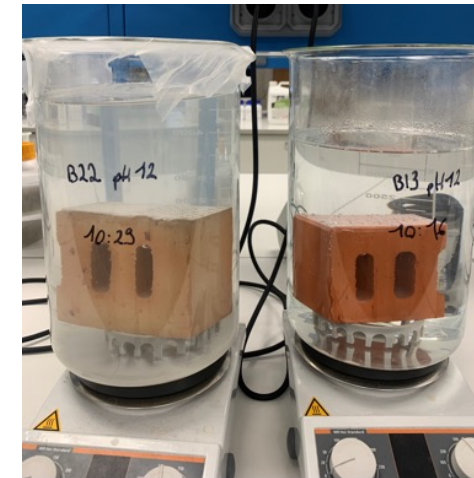
- **Provide assistance before, during and after worksite.**



Our company

➤ Tests at lab scale

- **Chemical analysis :**
FTIR, XRF, DSC, TGA, spectrophotometer, ICP, HPLC...
- **Physical and mechanical properties:**
viscosity, water and water vapor permeability, mechanical properties, microscopic analysis, porosimetry, pycnometry, carbonation with CO₂, adherence of product before and after ageing
- **Different ageing capacity :**
Climatic chamber, oven, water immersion, refrigerator



Our company

➤ Tests at large scale

- Resistance to ageing



Cycles of heat/rain/frost to simulate 20 years ageing

- Thermal performances



Thermal performances of a wall

- Acoustic performances



- Mechanical performances



Large size mechanical test

- 3D printer



→ Tests according to official standards or experimental investigations

Small projects

Small projects 1

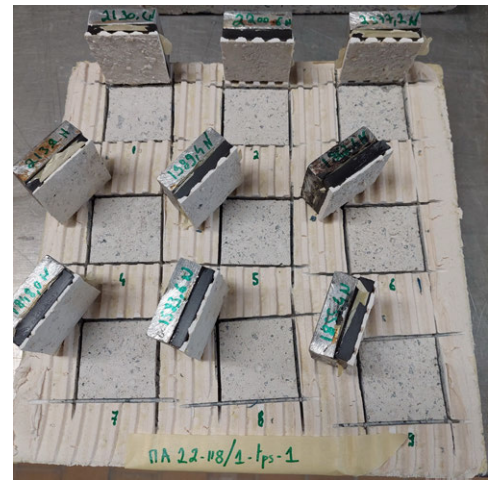
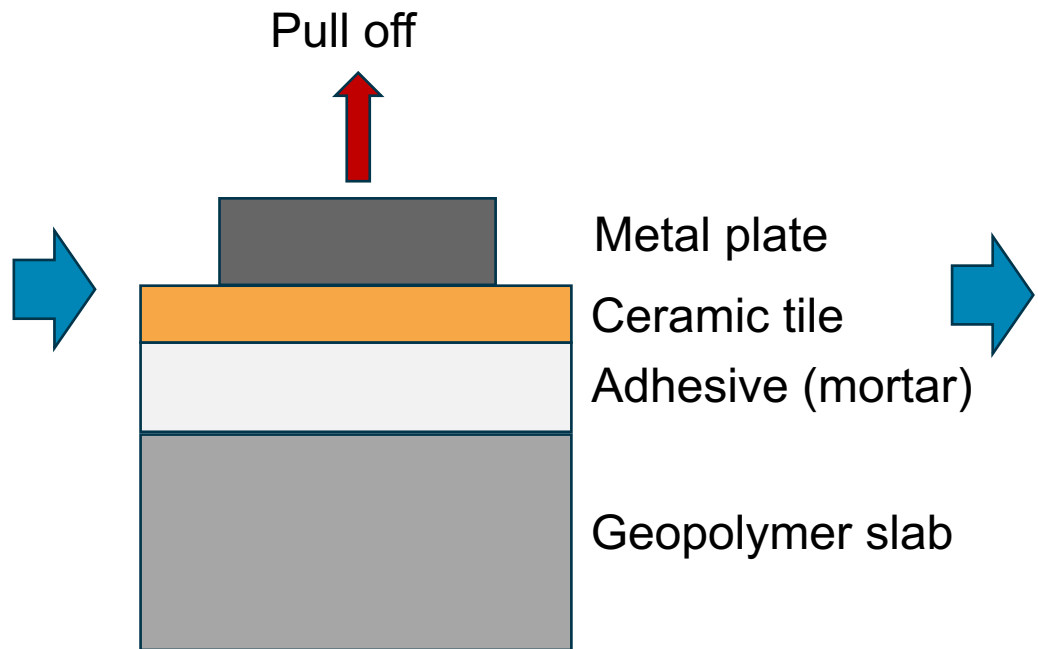
- **Case 1 : Compatibility between “geopolymers” slabs and commercial tile adhesives (mortar)**

- After 28 days at 23°C / 50% or 70°C :

Test according to EN 12004-2 (2017) :



Geopolymer slabs



Correct (> 1 N/mm²)

- After water immersion :



Very low (< 0,1 N/mm²)

Cement destroyed

Efflorescences of Na

Hypothesis :
Not well polymerized ?
Free NaOH attacked the cement ?

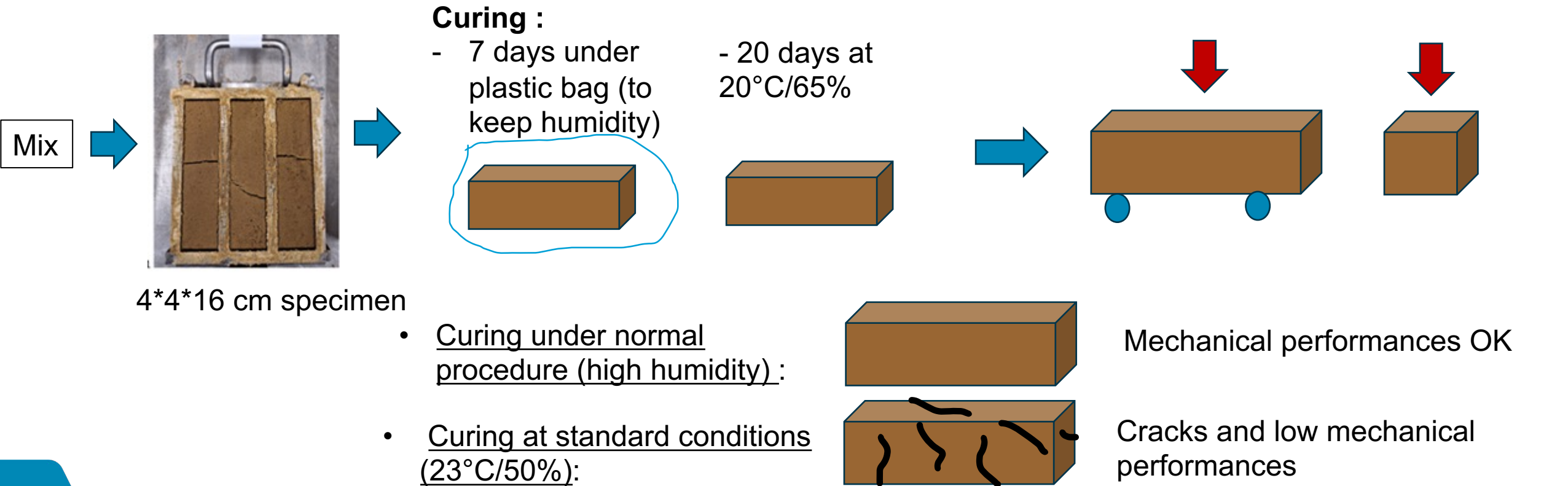
Small projects 2

▪ Case 2 : Geopolymer mortar for masonry wall

Test of a geopolymer designed for masonry wall.

Flexural and compressive test NBN EN 1015-11 (2019)

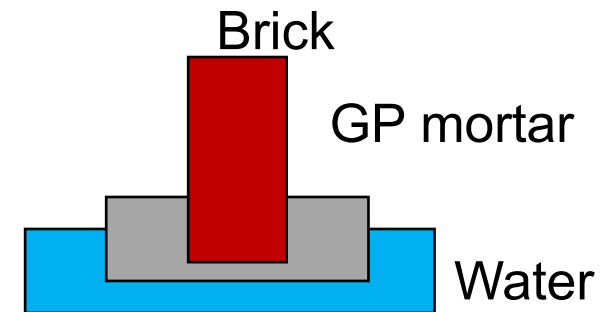
Procedure for a common mortar:



Small projects 2

- **Case 2 : Geopolymer mortar for masonry wall**

Compatibility with other building materials : test of efflorescences (NF_EN_771-1+A1_CN; Annex G (2017))



In progress

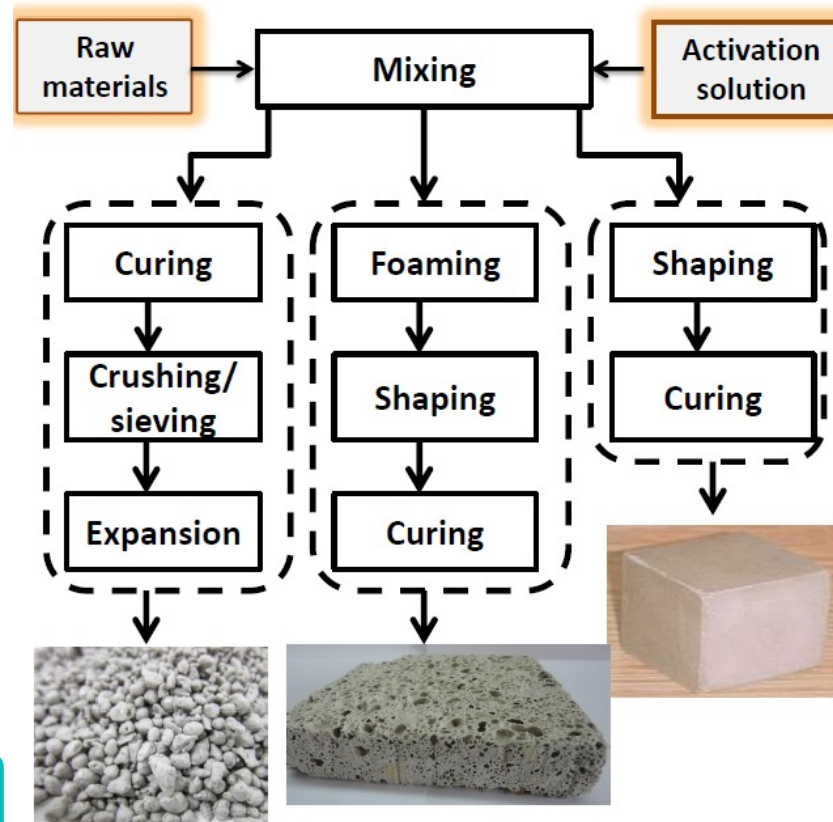
Larger projects

Project LEEMA

- Case1 : 2012-2015;
Low Embodied Energy Advanced Insulation Materials (LEEMA)



Low energy production



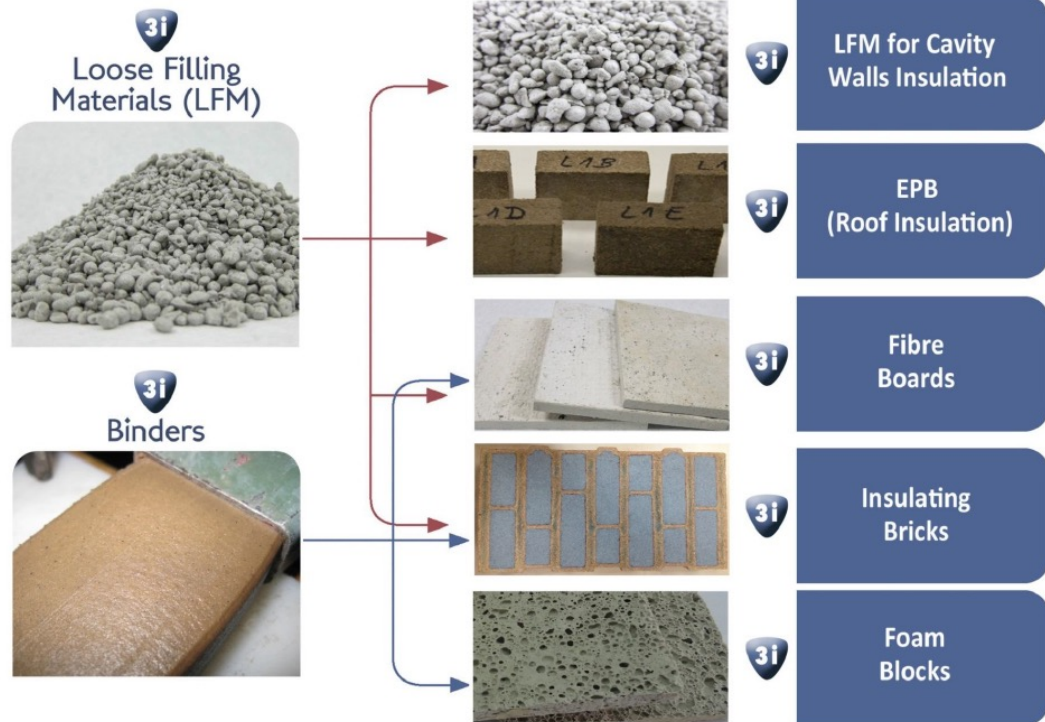
- ✓ Use of mineral tailings-wastes, recycled glass and other industrial by-products
- ✓ Curing at low temperatures (50-100 °C) for 24-72h to obtain mechanical properties
- ✓ Expansion using energy efficient Infrared Heating

Project LEEMA



- **Case1 : 2012-2015;**
Low Embodied Energy Advanced Insulation Materials (LEEMA)

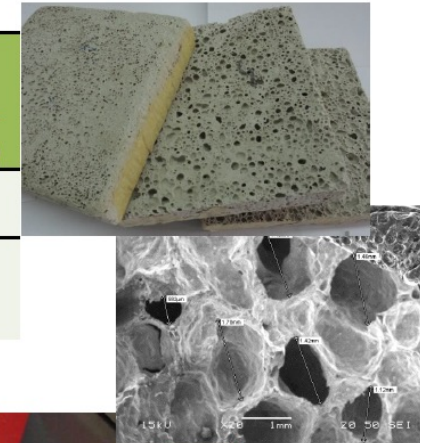
The LEEMA Products



3I Foam Blocks



| Material Type | λ (W/(mK)) | Density (Kg/m ³) | Comp. Strength (MPa) | 1/R for 20cm thickness (... is approx. U-value) (W/(m ² K)) |
|-----------------------------|--------------------|------------------------------|----------------------|--|
| 3I Foamed Blocks | 0.06 – 0.115 | 400-800 | 0.7 – 2.7 | 0.3-0.6 |
| Autoclaved Aerated Concrete | 0.07-1.4 | 200-1600 | 1-10 | 0.35-7.0 |



Main advantages

- ✓ Foamed inorganic polymers
- ✓ Sustainable: Based on perlite wastes
- ✓ Inorganic or organic foaming agents
- ✓ Mechanical properties obtained after curing at low temperatures (~70 °C) after a few days
- ✓ Easy to cut – retain shape and strength



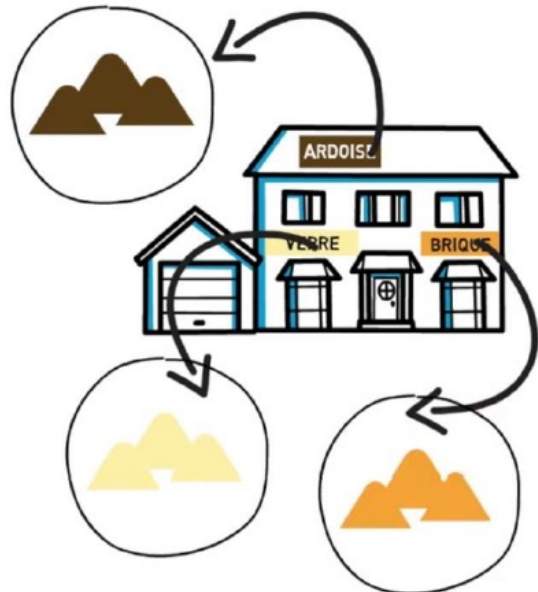
More information about the project :

<https://cordis.europa.eu/docs/results/285/285059/periodic2-leema-36m-pr-publishable-summary.pdf>

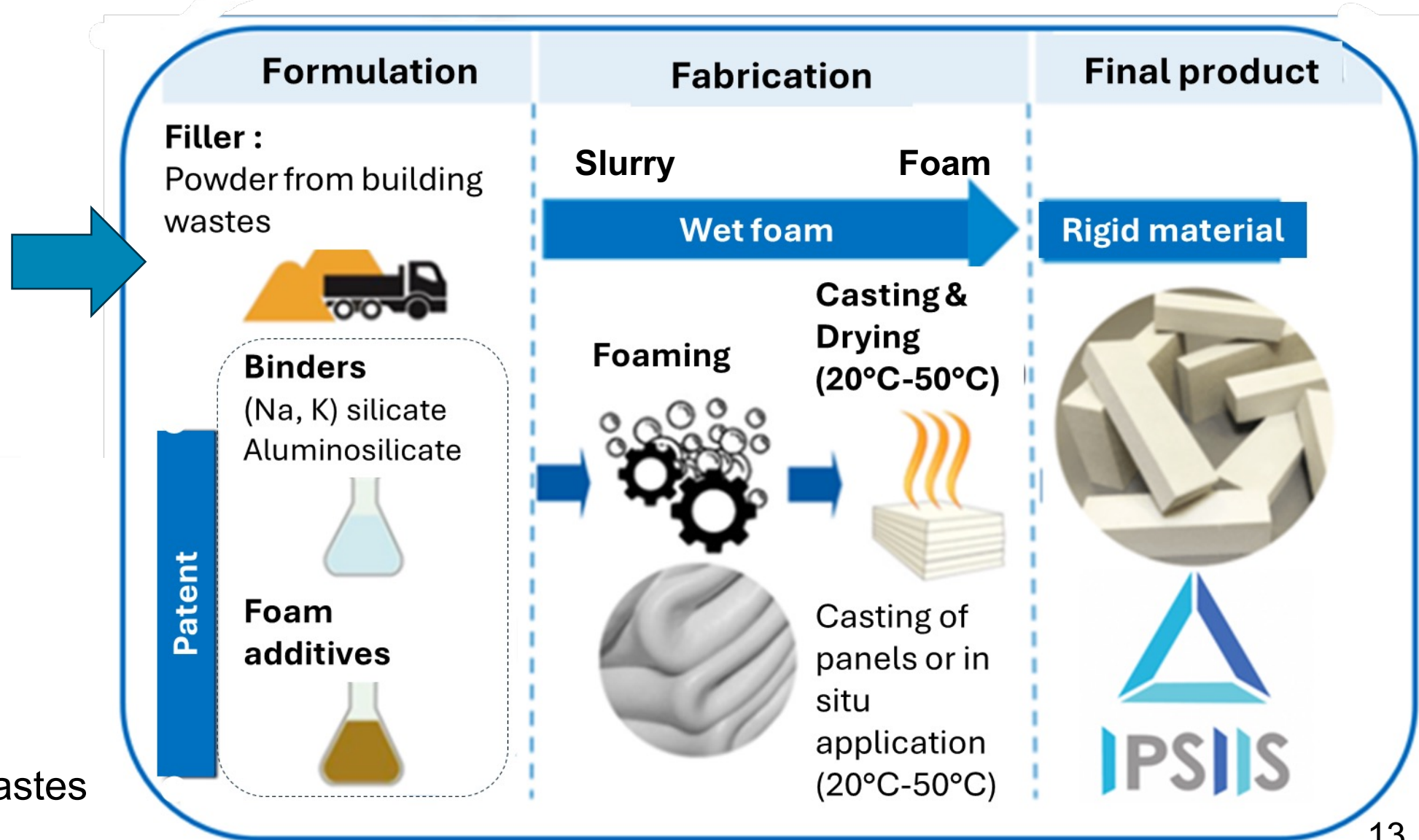
<https://www.youtube.com/watch?v=Ci0AB4UMIU>

Project IRMA-REMIND

- **Case 2 : 2022-2025; Project IRMA-REMIND, collaboration with IPSIIS company**
Manufacture of insulating and refractory materials from industrial or demolition waste



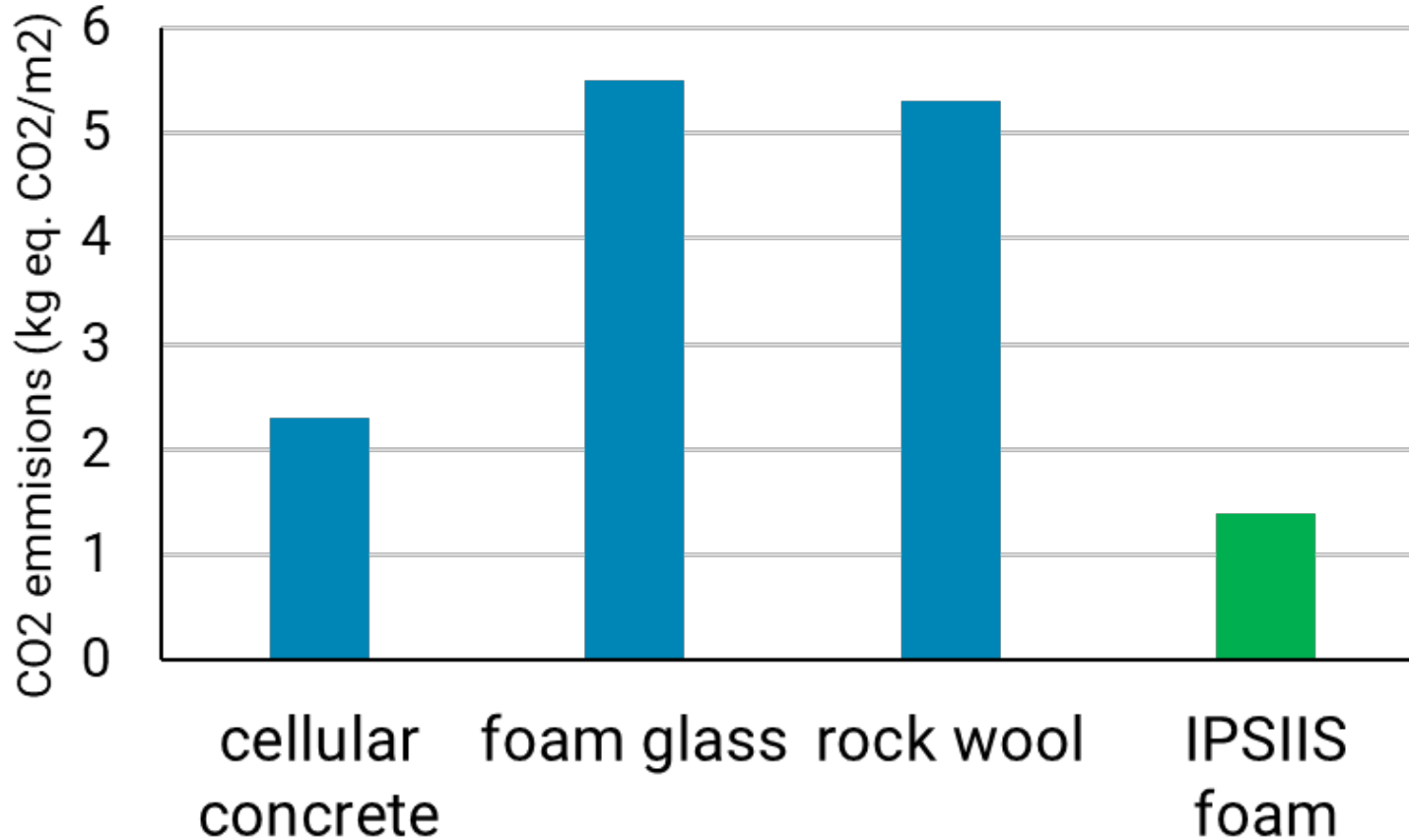
- Bricks
 - Mineral wools
 - Glass
 - Marble, stone
- Also :**
- River sediments
 - Stone carriers wastes
 - Concrete



Larger project 2

- Case 2 : 2022-2025; Project IRMA-REMIND :

- CO₂ emission for identical thermal performances (R = 1 m².K/W)



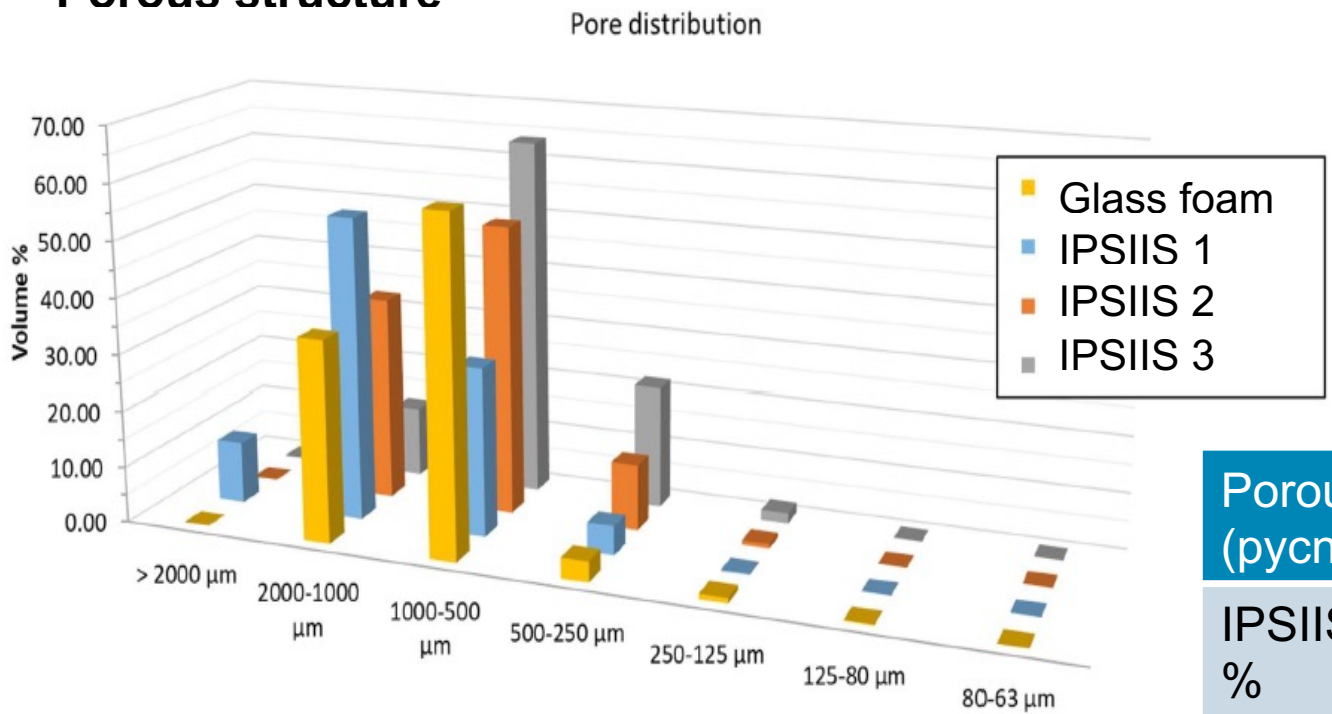
High impact :
- Aluminosilicate
- Grinding of wastes in fine powder

Rough estimations based on LCA analysis

Larger project 2

- **Case 2 : 2022-2025; Project IRMA-REMIND :**

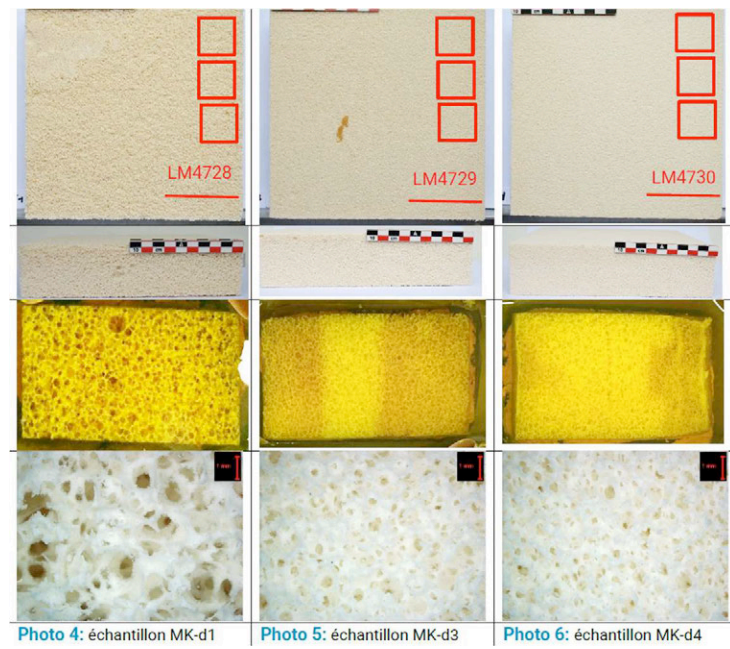
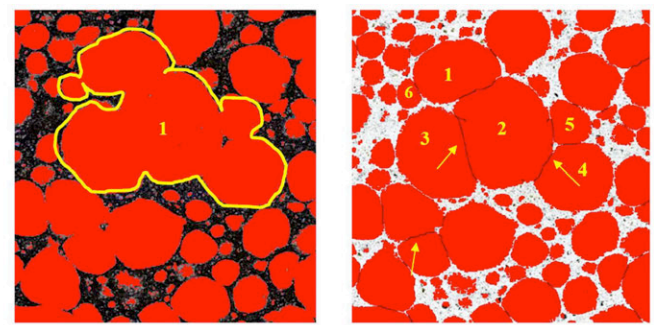
- **Porous structure**



→ Similar to glass foam

Porous volume (pycnometry He)
 IPSIIS foams : 80-90 %
 Glass foam : 20%

Challenge :
 Getting a more close porous structure to reach better thermal conductivity



Any idea ?

Larger project 2

- **Case 2 : 2022-2025; Project IRMA-REMIND :**

- **Thermal performances :**

- From 0,035 to 0,100 [W/(m.K)], depending on the density and compressive strength.

- **Mechanical performances :**

- Compressive strength higher than 150 kPa for 10% deformation (insulation criteria)
- Possible to apply a render on it (adherence : 0,08 N/mm²)

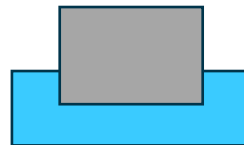
- **Durability, stability :**

- Mechanical resistance OK after :

Thermal treatment
(1h at 800°C) ✓



Water contact
(24h in H₂O) ✓

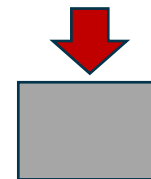


Dimensional stability 1
(EN 1604) ✓



48h at 70°C
RH = 90%

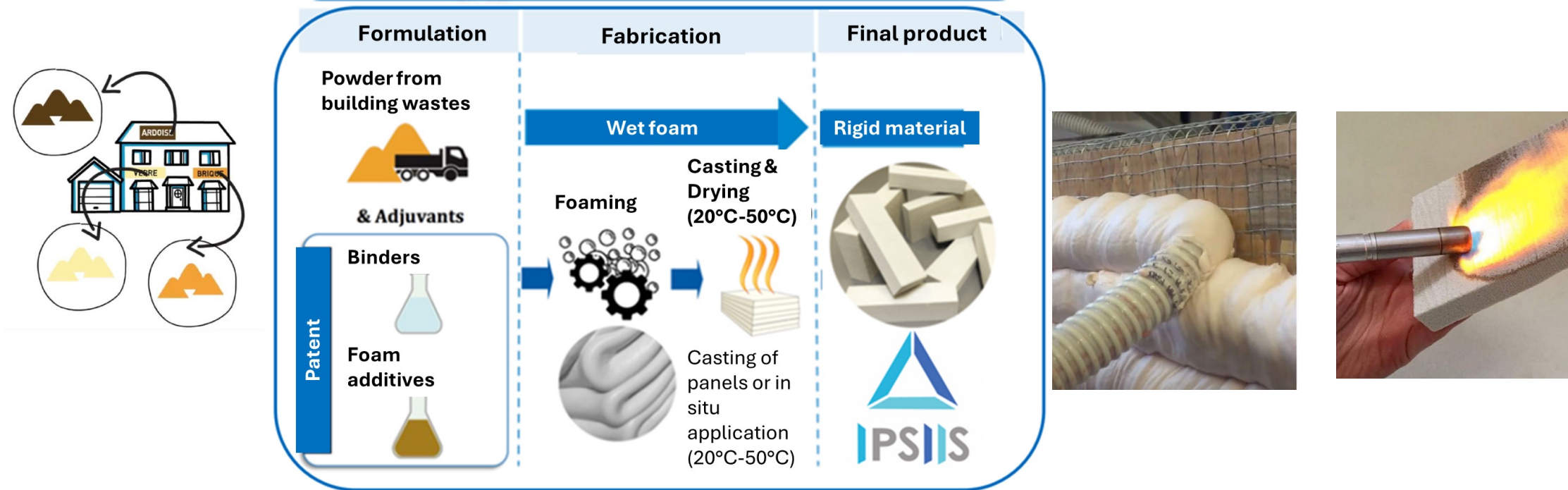
Dimensional stability 2
(EN 1605) ✓



7 days
40 kPa
70°C

Project IRMA-REMIND

- Case 2 : 2022-2025; Project IRMA-REMIND, collaboration with IPSIIS company



- Valorization of demolition wastes
- Non toxic
- Low emission of CO₂
- Fire resistant
- Resistant to water

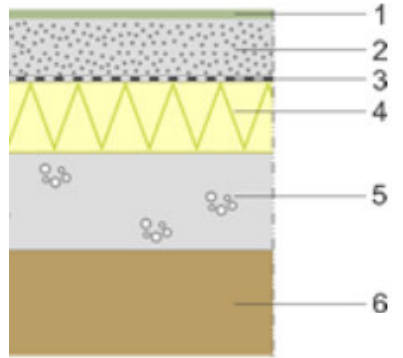


Larger project 2

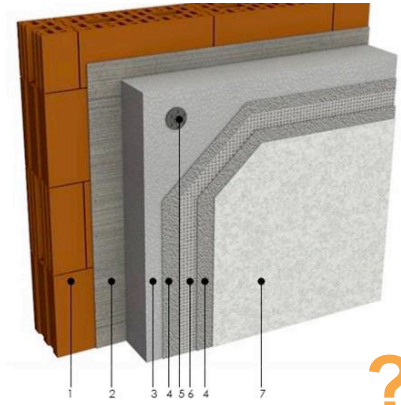
- **Case 2 : 2022-2025; Project IRMA-REMIND :**
 - **A world of possibilities in construction field !**



To reduce amount of concrete



Floor insulation



1. Support
2. Adhésif
3. Isolant
4. Enduit de base
5. Ancrage mécanique (éventuel)
6. Tissu d'armature
7. Enduit de finition

Intern and extern wall insulation



Roof insulation



Filling up of cavities or under the roof
→ **Walls up to 3 meters !**



Fire safety

Larger projects

- **Case 2 : 2022-2025; Project IRMA-REMIND :**

IPSIIS is looking for partners, do not hesitate to contact them ! :

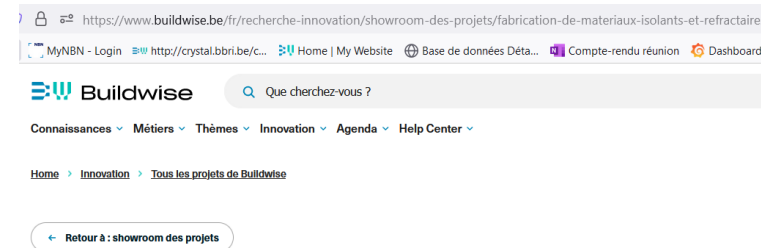
Web site :

<https://ipsiis.com/>



For more information about the project :

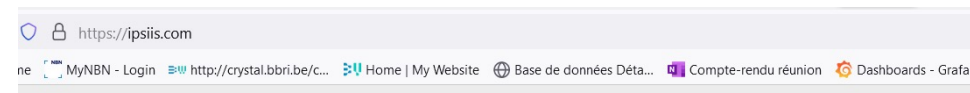
Buildwise website → IRMA-REMIND project



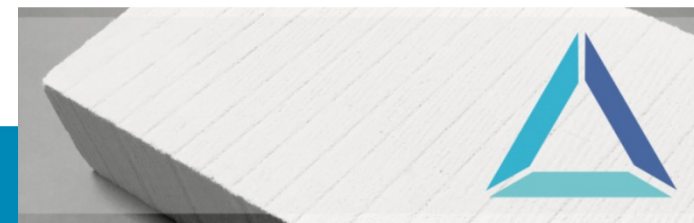
Fabrication de matériaux isolants et réfractaires à base de déchets industriels ou de déconstruction - IRMA

On peut recycler des déchets industriels inertes ou de déconstruction dans la production de mousses minérales pour l'isolation thermique des bâtiments et la protection incendie.

<https://www.buildwise.be/fr/recherche-innovation/showroom-des-projets/fabrication-de-materiaux-isolants-et-refractaires-a-base-de-dechets-industriels-ou-de-deconstruction-irma/>



IPSIIS *Innovative Processes, Sustainable Inspiring Insulation Solutions*



ACCUEIL CONCEPT APPLICATIONS MATÉRIAUX ACTUALITES PHOTOS & V

Buildwise

**Thank you for your
attention**