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Geopolymer cement from vitreous precursors – pilot scale testing of paver production

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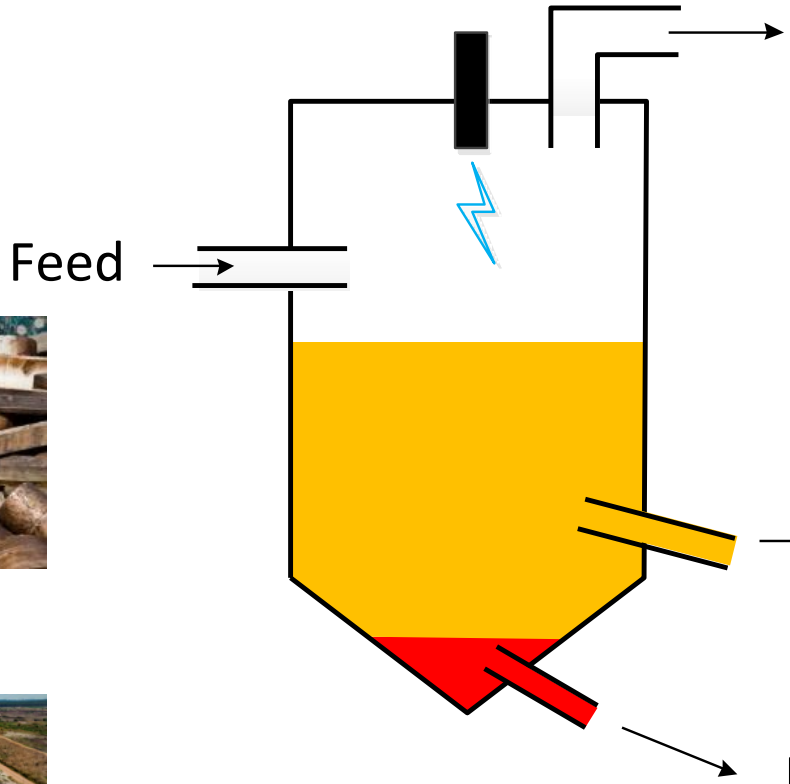
Geopolymer Camp, July 7, 2015

Slags – secondary resources for cement

Municipal solid waste – Refuse derived fuel

Metal scrap

Metallurgical sludges – goethite, red mud



Cement in construction applications

Pilot tests for slag production

Pilot tests for slag production

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Geopolymer polymer cement from vitreous precursors

Milled slag + Water glass + Sand, rocks = Slag based inorganic polymer concrete

= Low carbon footprint
= Easy in use in existing installations running on OPC
= No big investments required
= Competitive price with OPC
= Broad range of applications
= Building products with improved properties

Pontikes et al., 2013. Applied clay Science, 73, 93-102;
Machiels et al., 2014. Waste Biomass Valorisation, 5, 411-428;
Danthurebandara et al., 2015. Journal of Cleaner Production.

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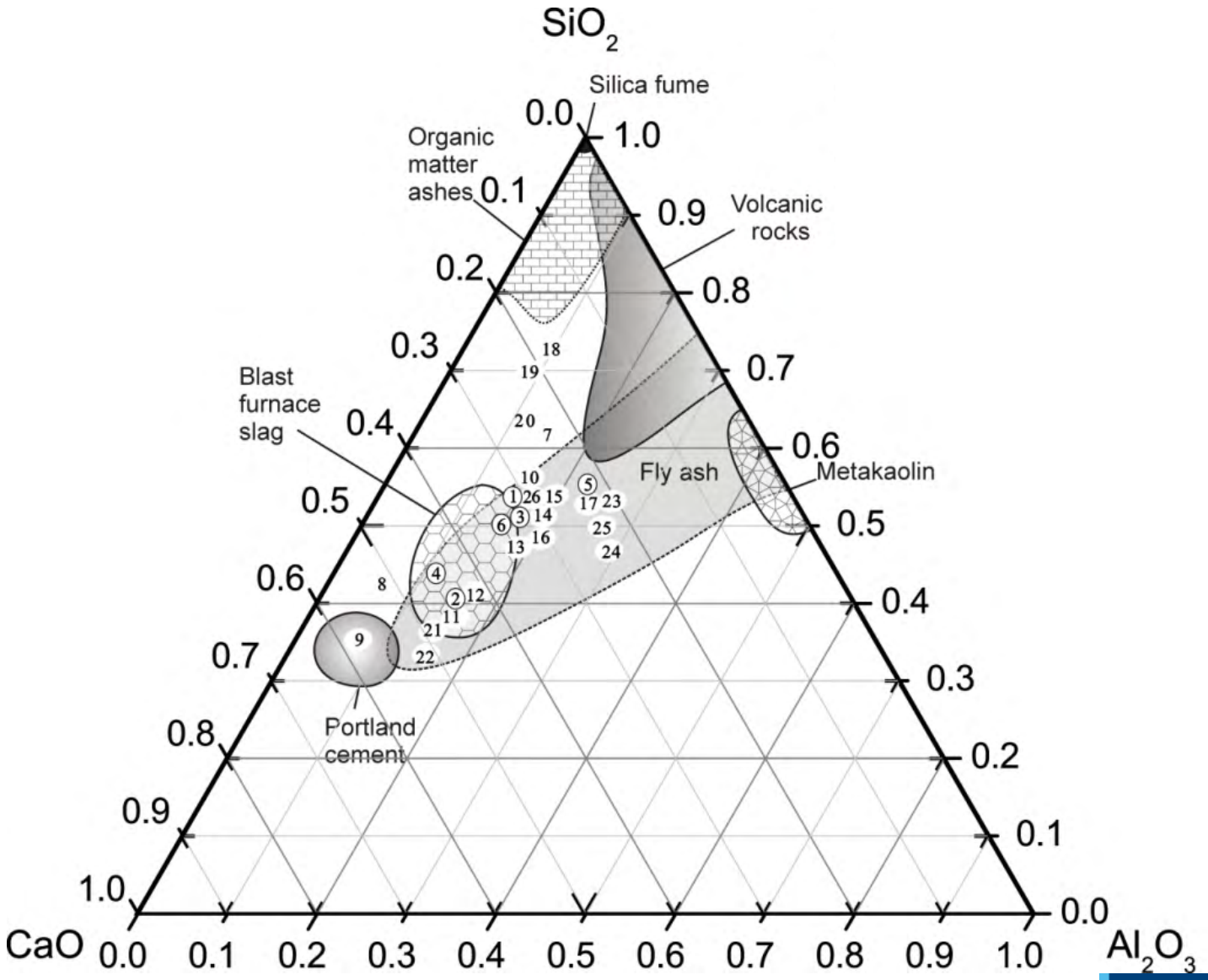
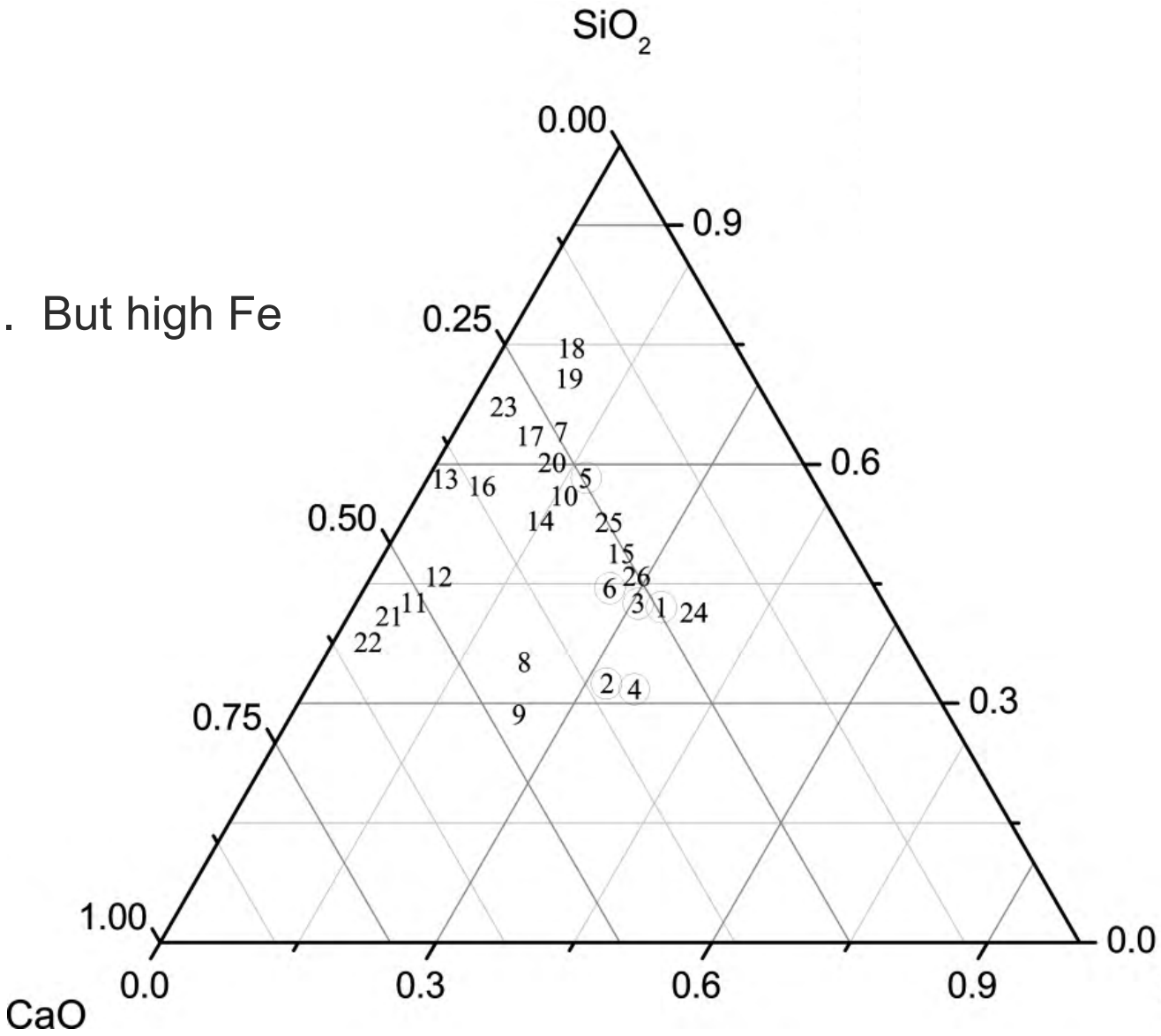
Compositional variation

Low Al..



Compositional variation

Low Al.. But high Fe



Glass synthesis

G1 –
25% Al_2O_3

G5 –
25% Fe_2O_3

- Melting 100° above glass melting point
- Air atmosphere
- Water quenched (nearly 100% glassy)

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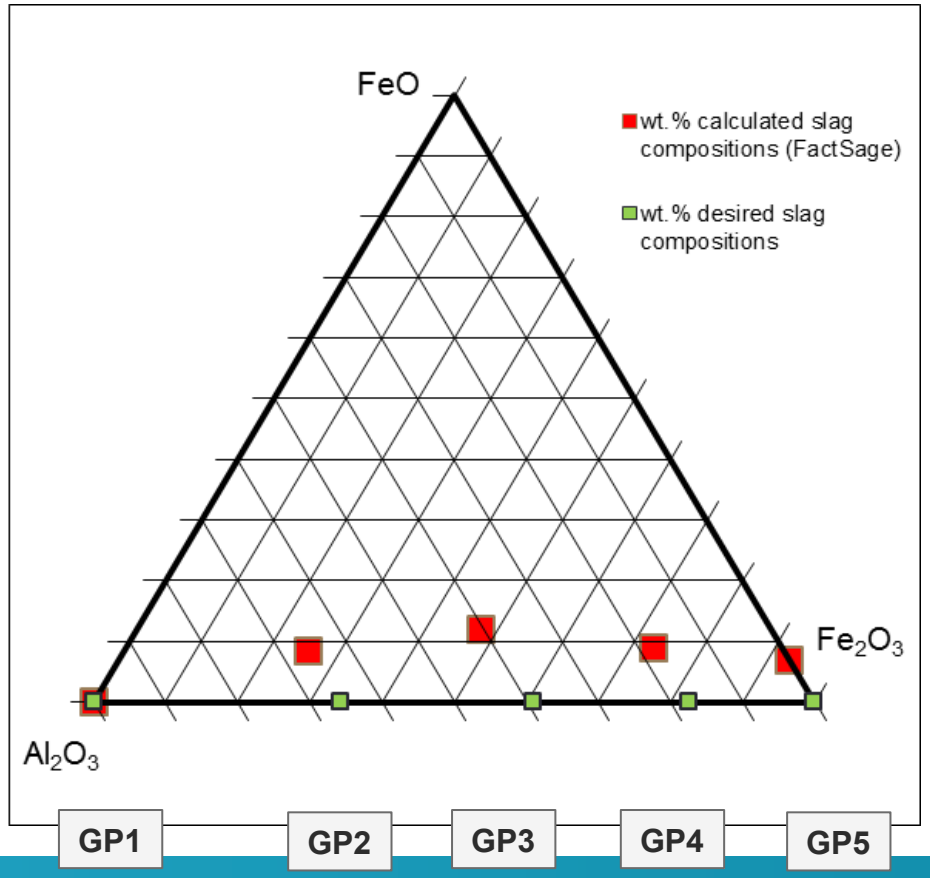
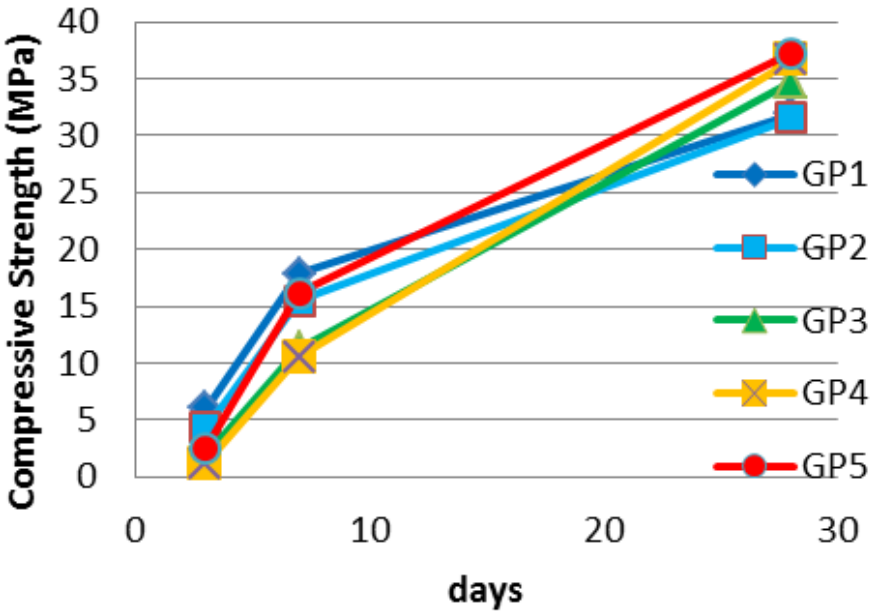
Research for cement development: Al or Fe?

Composition of refuse derived fuel vs. traditional raw materials?

- "Traditional inorganic polymers are Si-Al based"
- Al content is commonly low

- But.. considerable amounts of Fe are present, 20% Fe_2O_3 is common
- Research on role of Fe in inorganic polymers





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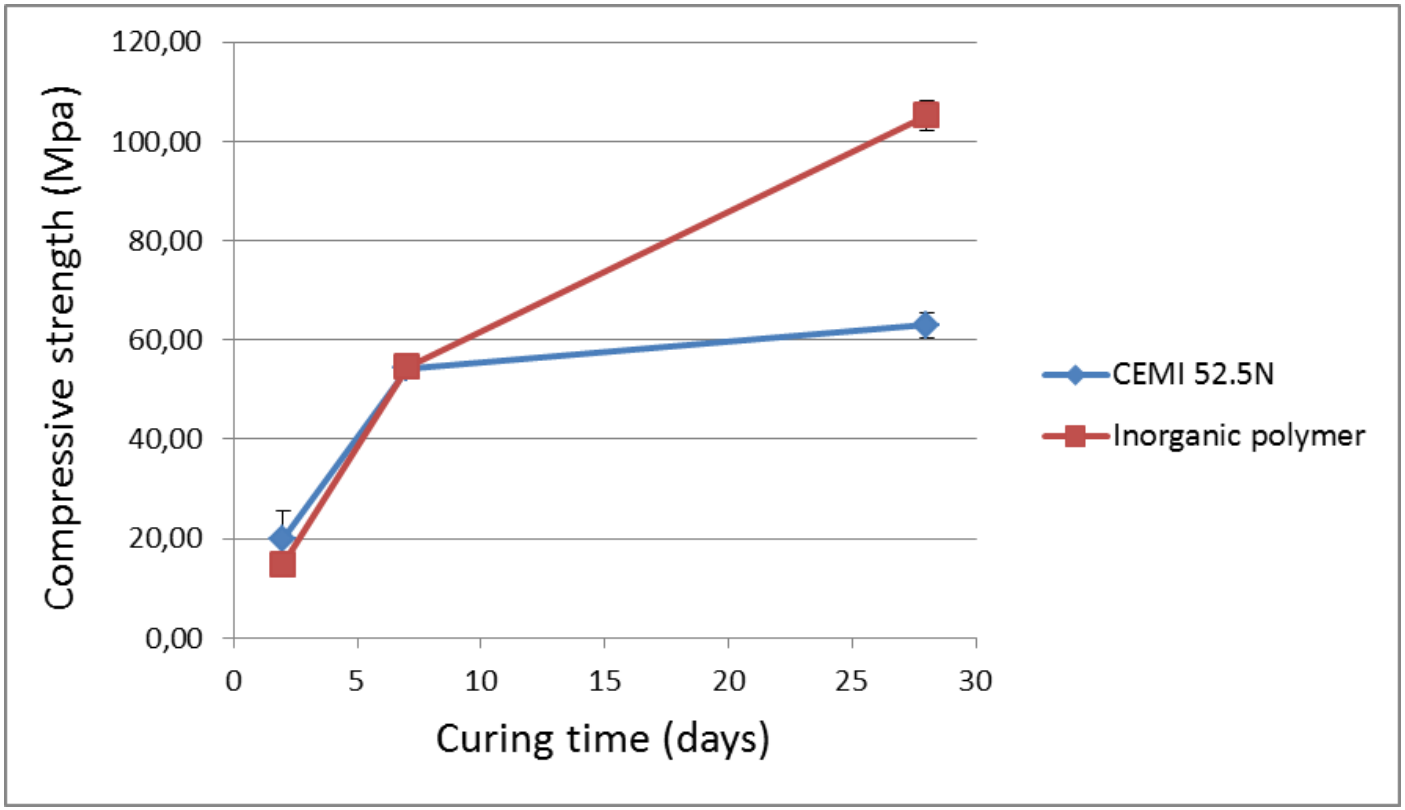
Research for cement development: lab scale

Example: Castable inorganic polymer mortar

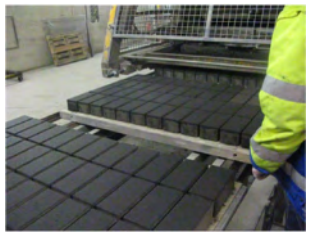
- Properties similar to CEMI 52.5N cement
- Ratio waterglass solution/slag: 0.5
- Room temperature curing 20°C



From the lab to the market

Joint R&D with partners from the whole value chain

Metallurgical industry → Cement and construction industry → Product desing Certification Marketing

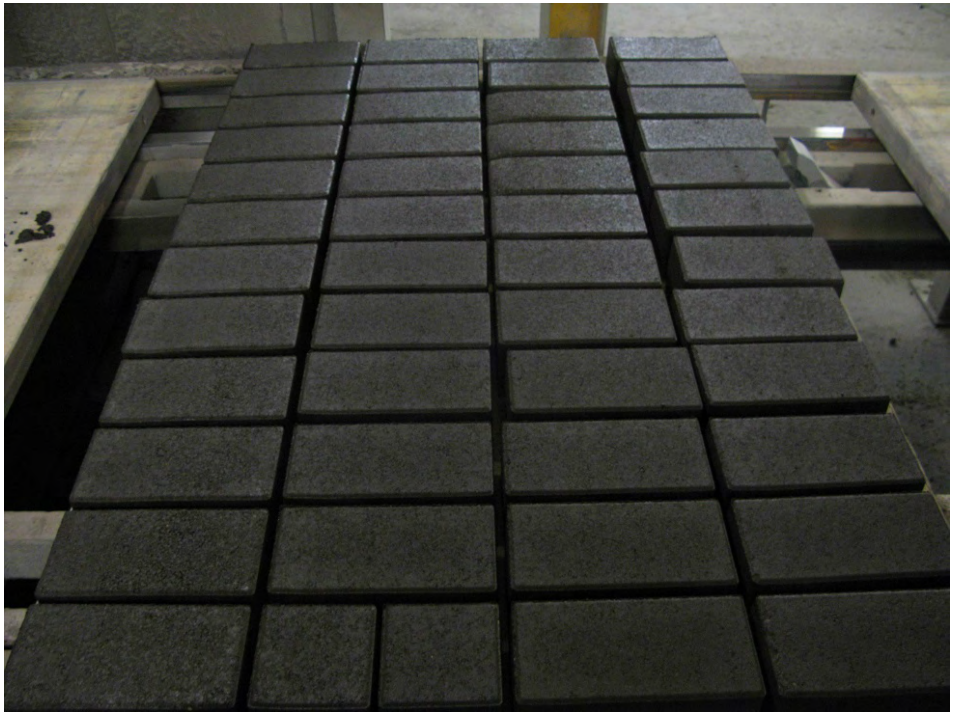


Industrial paver production- first full scale trial

Industrial paver production

Industrial paver production - first trial

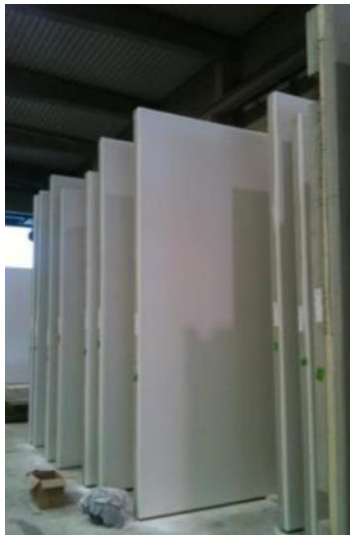
Industrial paver production- first full scale trial



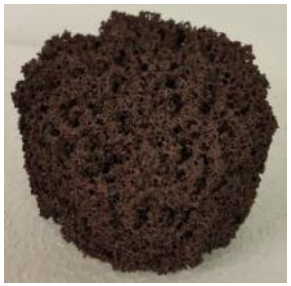
The future: high added value products

Ambition: building a house!

- Pavement stones
- Tiles
- Roofing tiles
- Bricks
- Walls
- Foundation
- Insulation panels
- Architectural concrete
- …



Original from OPC and PU



Geopolymer based

Example: replacement of polyurethane by foamed geopolymer cement in sandwich walls

Contact

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