

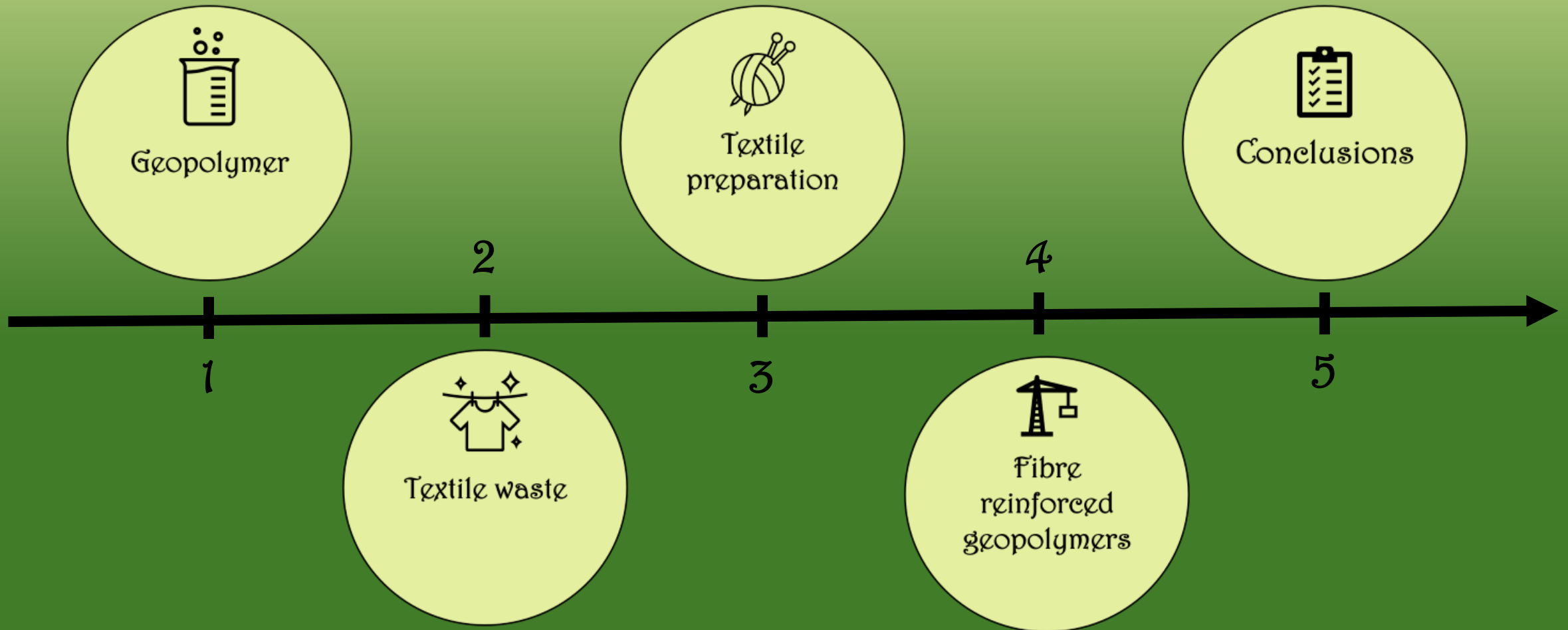
The Use of Textile Waste for Fibre-Reinforced Geopolymer Composite Production

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University of Miskolc

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Geopolymer

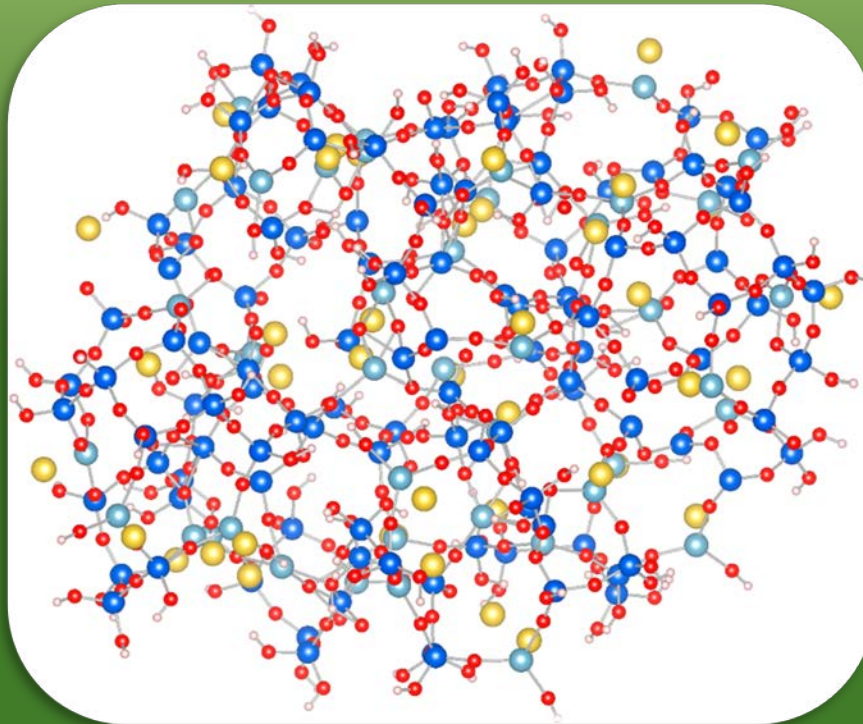
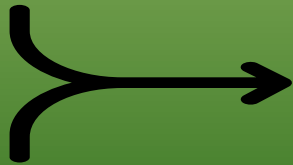


Activator solution



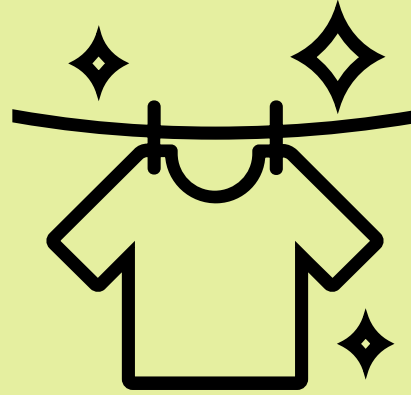
Geopolymer

Solid base material

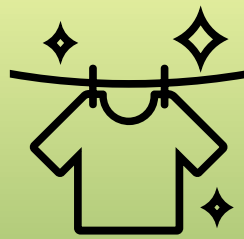


Structural model for geopolymer of over 800 atoms
with Si:Al ratio of 2.81 (Koleżyński et al., 2018)





Textile waste



Textile waste

Environmental Impact of Fast Fashion

SECOND MOST POLLUTING

Industry in the world (after oil)



TheRoundup.org



2.1 Billion Tonnes
of carbon emissions each year.

That's **4%** of the world's total



It takes
2000 GALLONS

of water to make just
one pair of jeans

Fashion Industry Causes

20%
GLOBAL WASTE
WATER

35%
MICROPLASTICS
IN OCEANS



Of materials used to
make clothing
**END UP IN
LANDFILL**



That's one truckload
EVERY SECOND



Of clothes are
**RECYCLED INTO
NEW GARMENTS**

TheRoundup.org

Sources: UNEP, European Parliament, Ellen MacArthur Foundation, UN, McKinsey

Textile waste from the industry
Unsellable textiles
Textile waste from customer

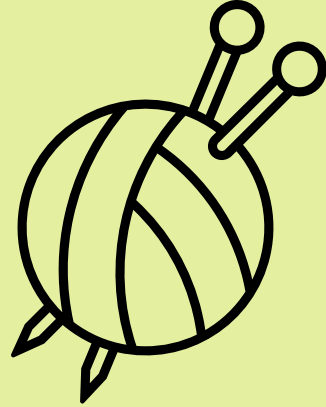


Sorting process

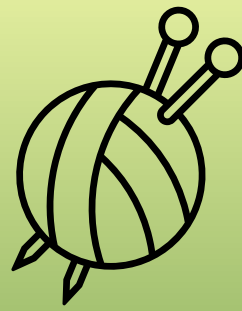
Reusable

Chemical recycling

Mechanical recycling



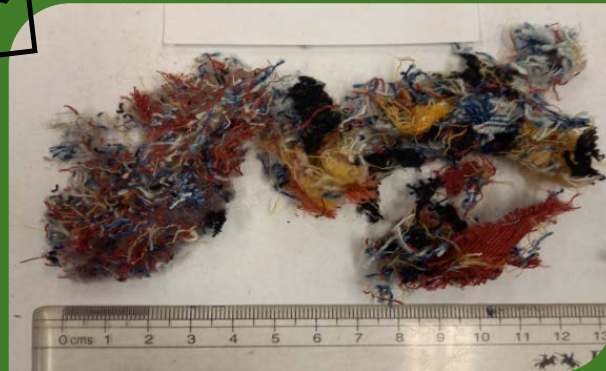
Textile preparation



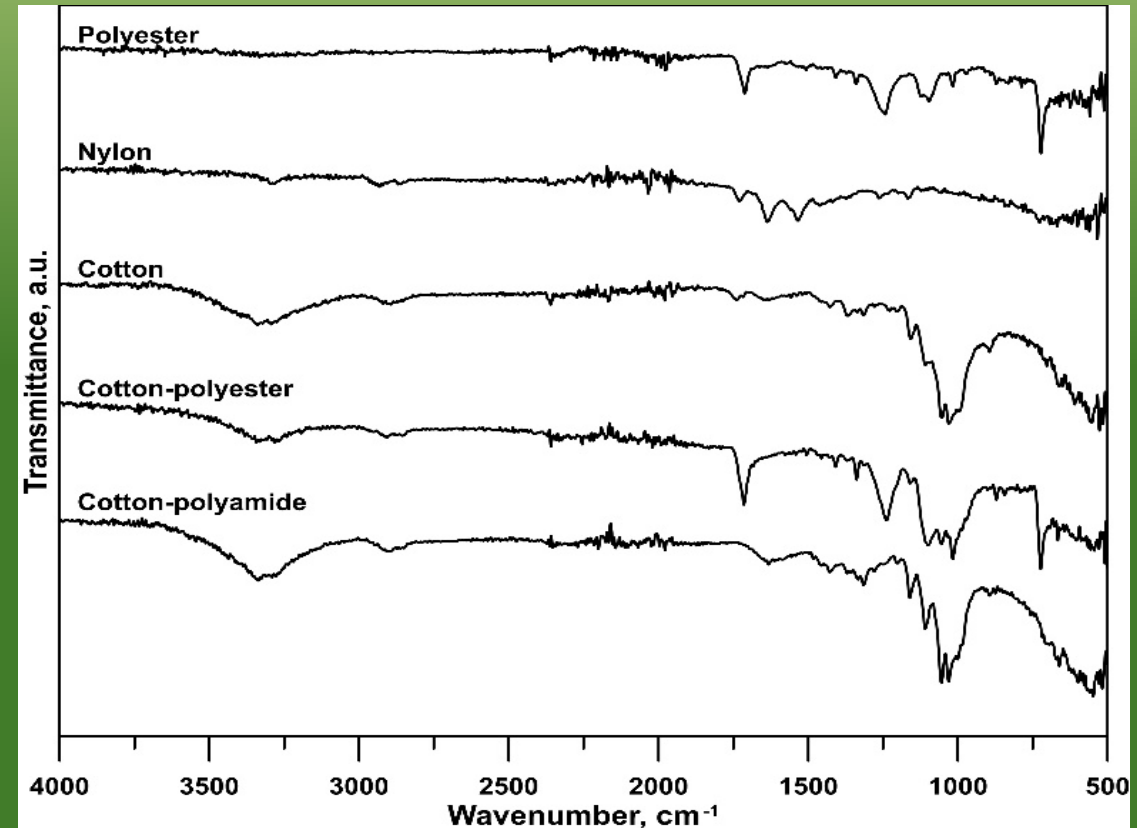
Textile preparation



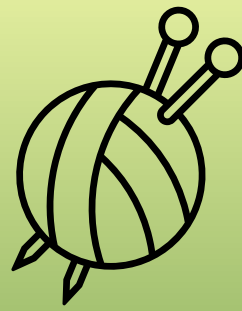
Base material



Fibre from textile waste



FT-IR spectra of the textile samples



Textile preparation



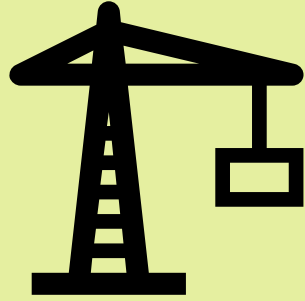
Axial rotary shear shredder



Vertical cutting mill



Horizontal cutting mill

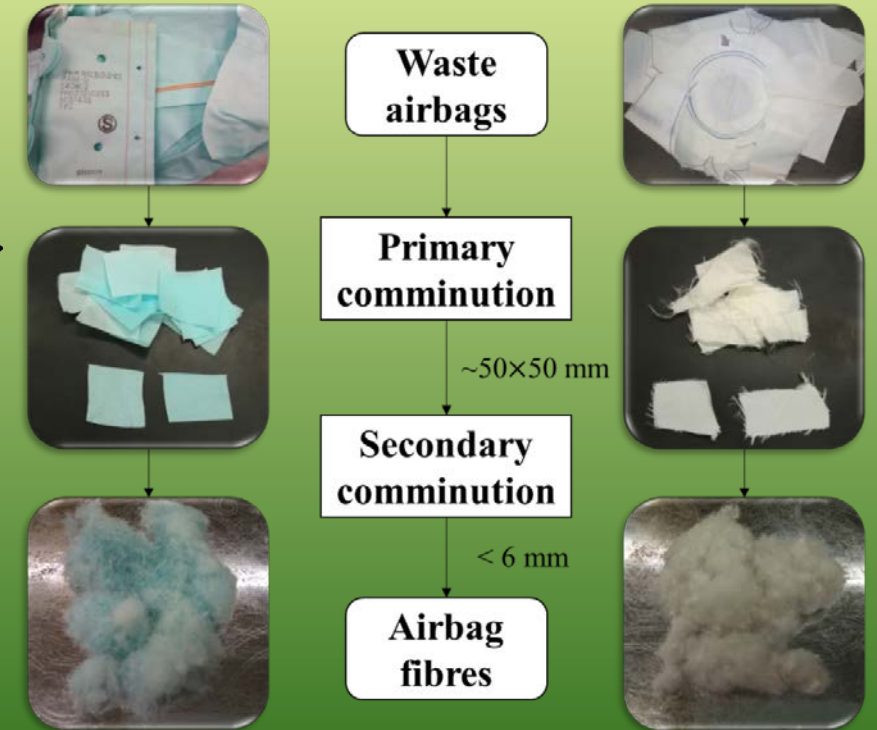
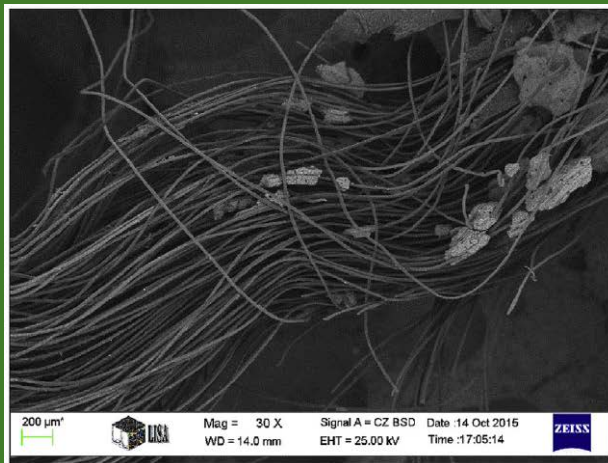


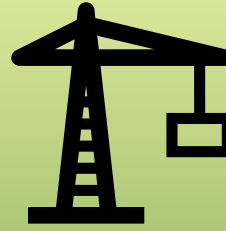
Fibre
reinforced
geopolymers

Fibre reinforced geopolymer from synergistic utilisation of fly ash and waste tyre

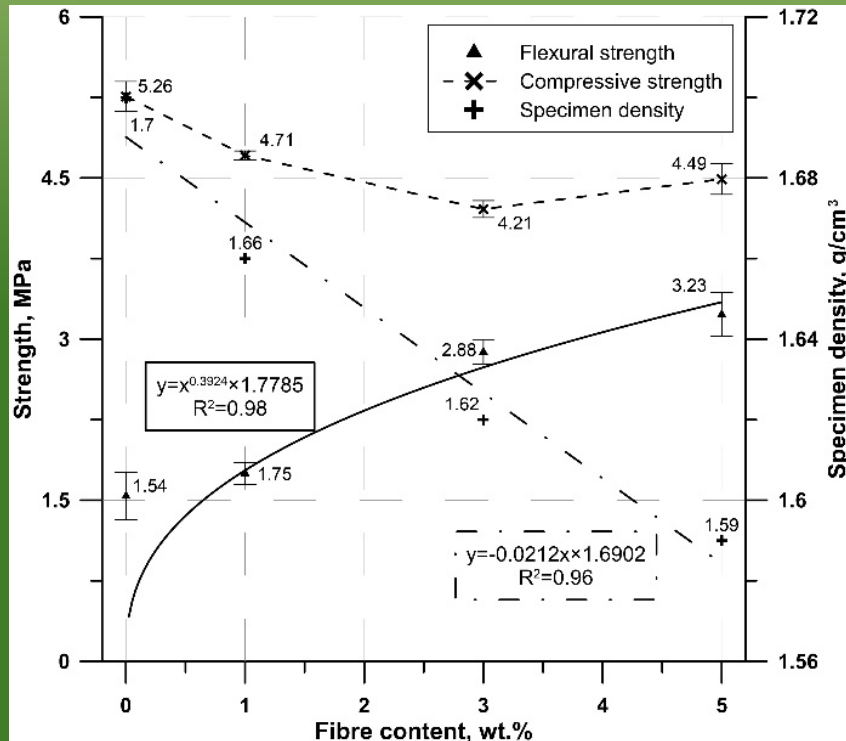
Fibre reinforced geopolymers

Preparation and Synergistic Utilisation of Waste Polymer Fibres and Fly Ash as Geopolymer Composite

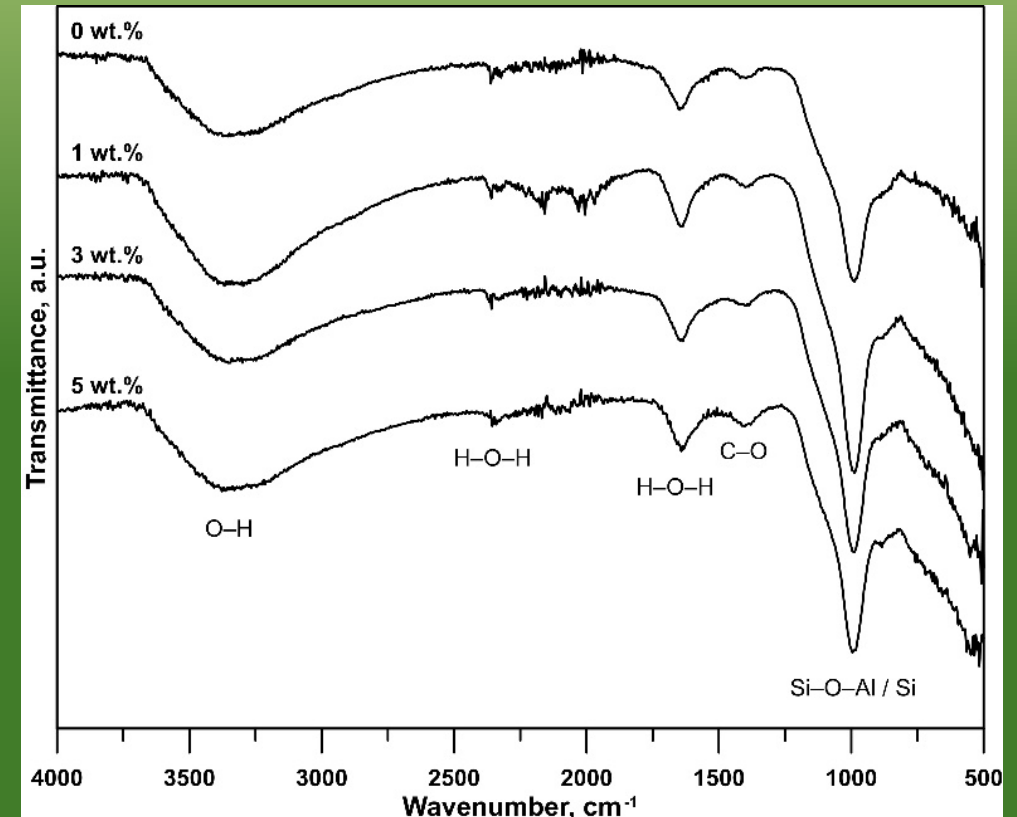




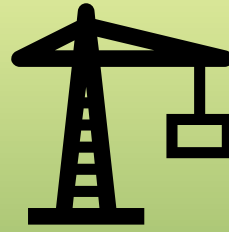
Fibre reinforced geopolymers



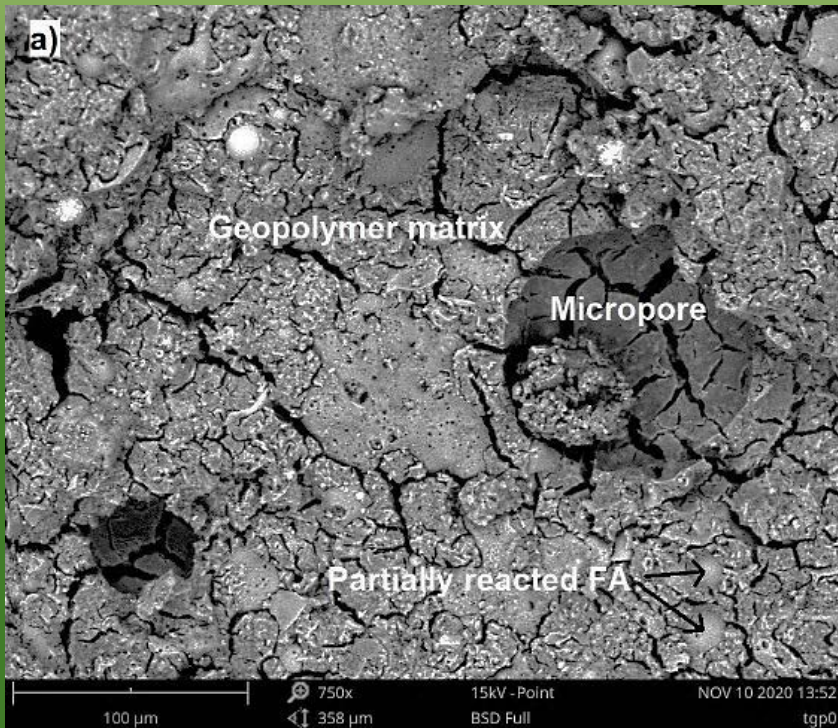
Physical properties of geopolymer composites



FT-IR spectra of geopolymer composites



Fibre reinforced geopolymers



Spot 1		Spot 2	
Element	wt.%	Element	wt.%
Si	33.13	O	46.50
C	23.17	Si	32.32
O	21.32	Na	6.85
Al	10.53	Al	6.66
Fe	4.72	Fe	3.85
Na	4.15	Ca	2.33
K	1.23	K	1.13
Mg	1.05	Mg	0.35
Ca	0.71		

SEM and EDS of the composites



Conclusions



Conclusions

- With 2-step communiton, fibres can be produced from cotton-based and synthetic polymeric textiles.
- The flexural strength could be successfully increased, but the compressive strength was slightly decreased, along with the specimen density.
- The fibres successfully penetrated the geopolymers gel, and good adhesion was observed.

Thank you for your attention!

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