



Northern Periphery and
Arctic Programme
2014–2020



EUROPEAN UNION

Investing in your future
European Regional Development Fund

ARCTIC TECHNOLOGY CENTRE



Enabling local communities to utilize waste fishing gear in construction materials



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Presentation outline



- Motivation
- Who are we?
- Why using fibre reinforcement in construction materials?
- Nylon 6 fibres from discarded nets for structural concrete
- PE fibres from discarded nets to prevent early age cracking
- What next?

Motivation

- Reuse of a waste material which is piling up in the Greenlandic dumps
- All construction materials transported to Greenland at high costs
- Do the waste fish nets have properties enabling use in the construction industry?



Arctic Technology Centre

- Arctic Technology Centre (ARTEK) was formally established in 2000
- The centre is located in Sisimiut (Greenland) and (Lyngby) Denmark
- BEng in Arctic Engineering and Master in cold climate engineering
- Research within: Arctic buildings and construction, environmental technology, and infrastructure



ZeroWaste Byg

- Redesigning construction materials towards a zero waste society

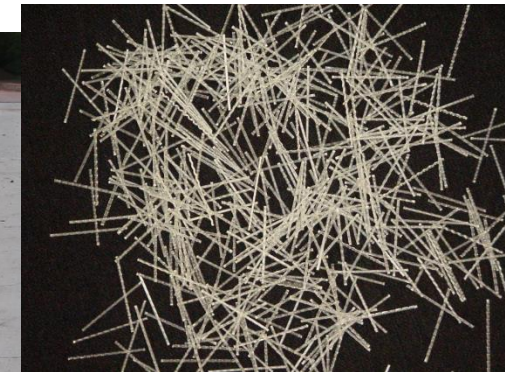


Why using fibre reinforcement?

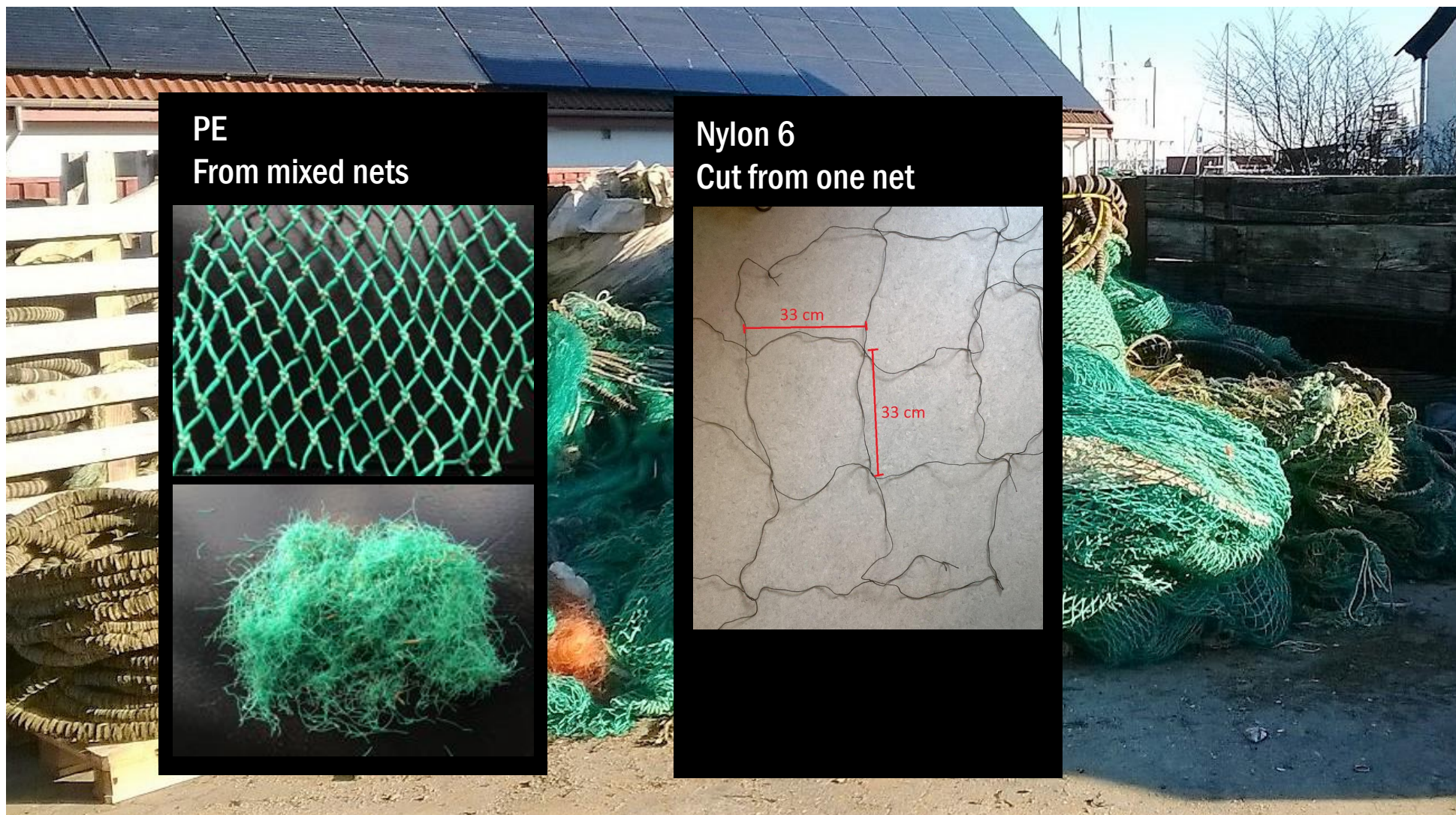


Why using fibre reinforcement?

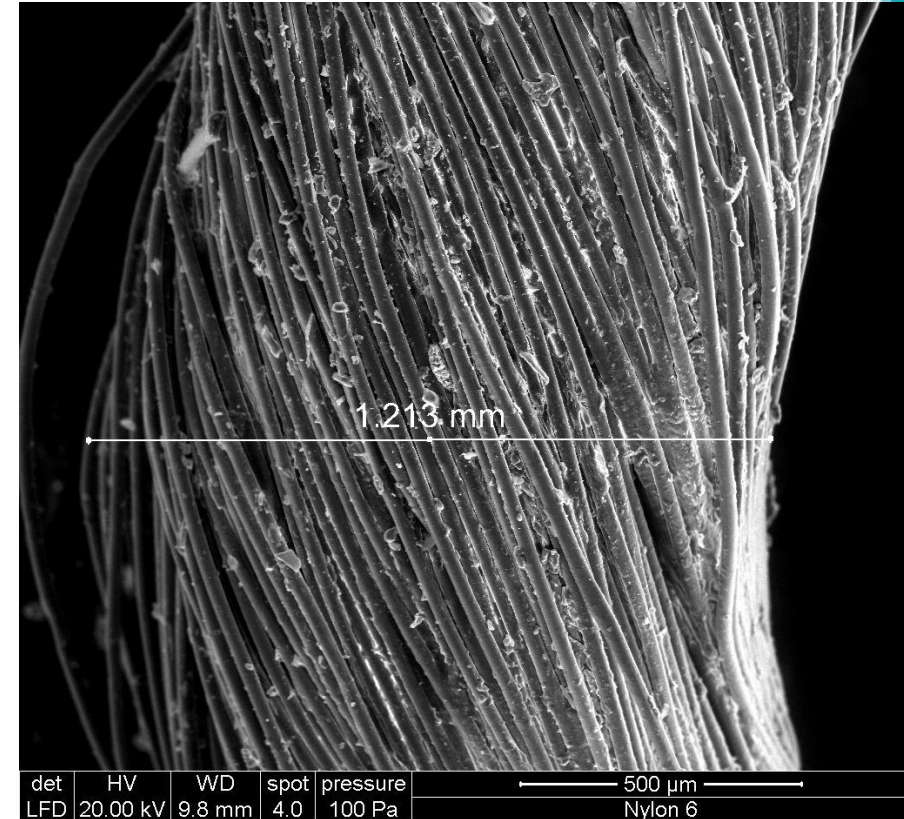
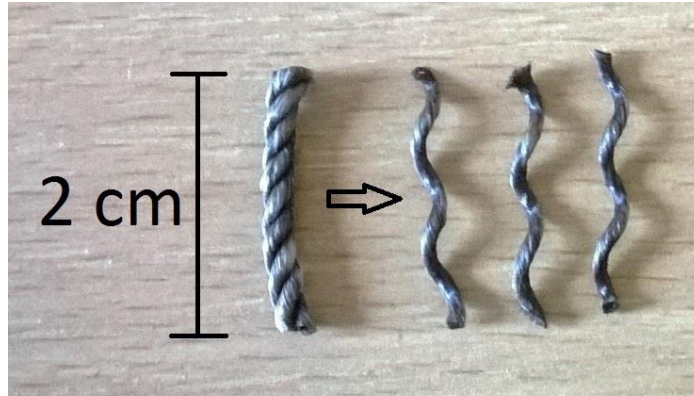
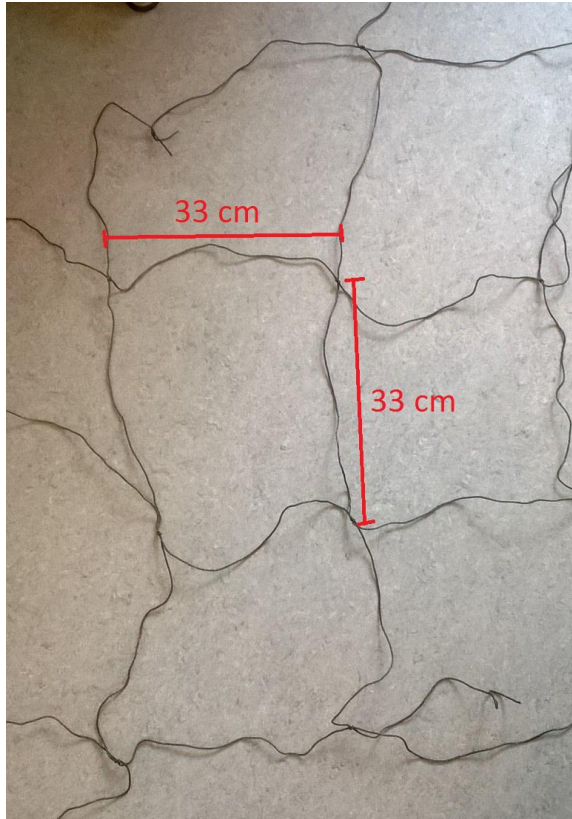
- The addition of fibres is an effective way to improve the performance of concrete
- For **structural** purposes – improvement of mechanical properties, e.g. ductility
- For **durability** purposes - control of plastic **shrinkage** cracking



Fishing nets for experiments



Nylon 6. Cut in 2 cm long fibres



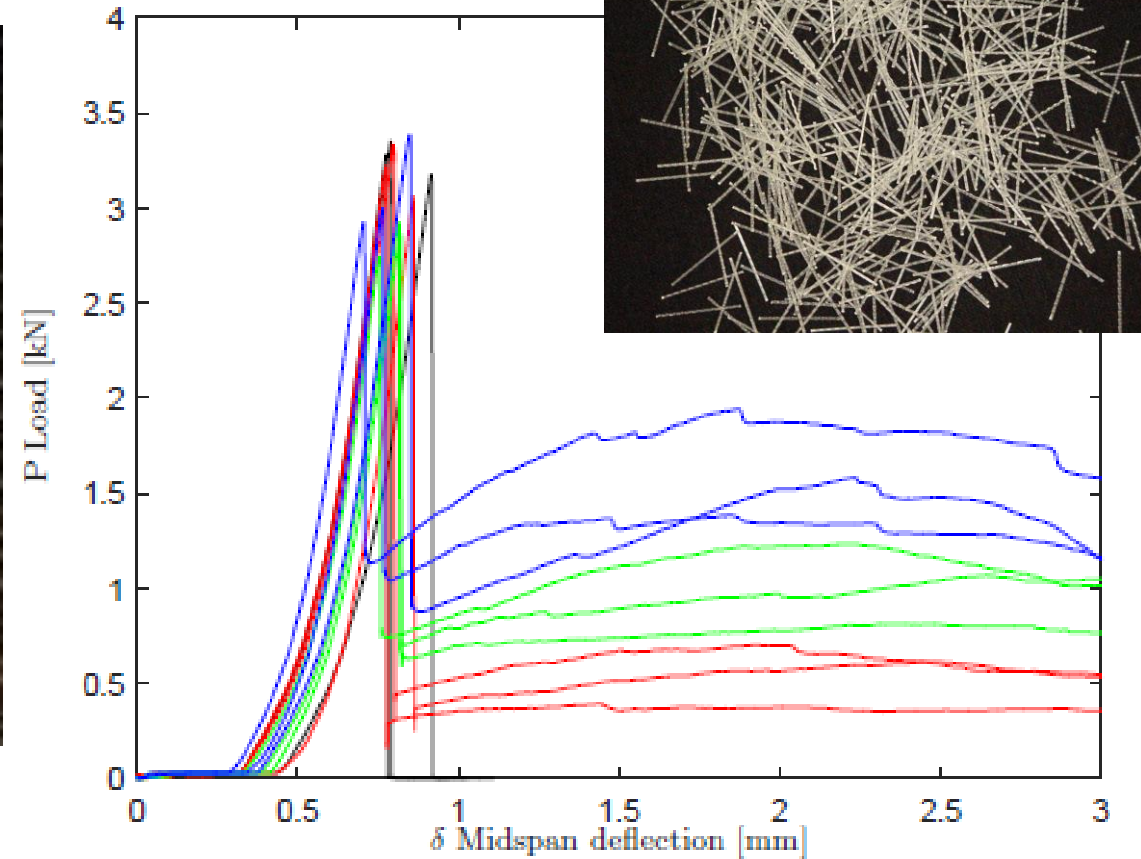
Structural purpose - flexural strength

Nylon 6. Cut in 2 cm long fibres



Structural purpose - flexural strength

Nylon 6. Cut in 2 cm long fibres

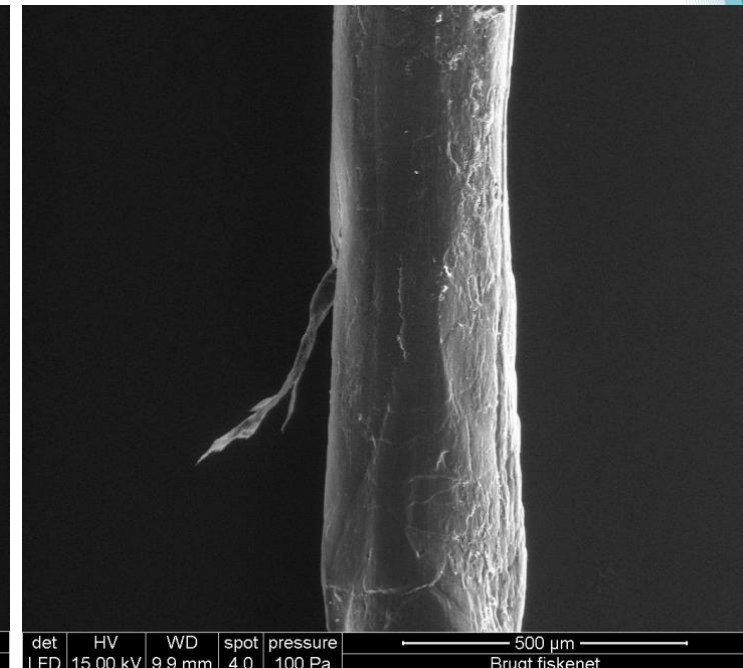
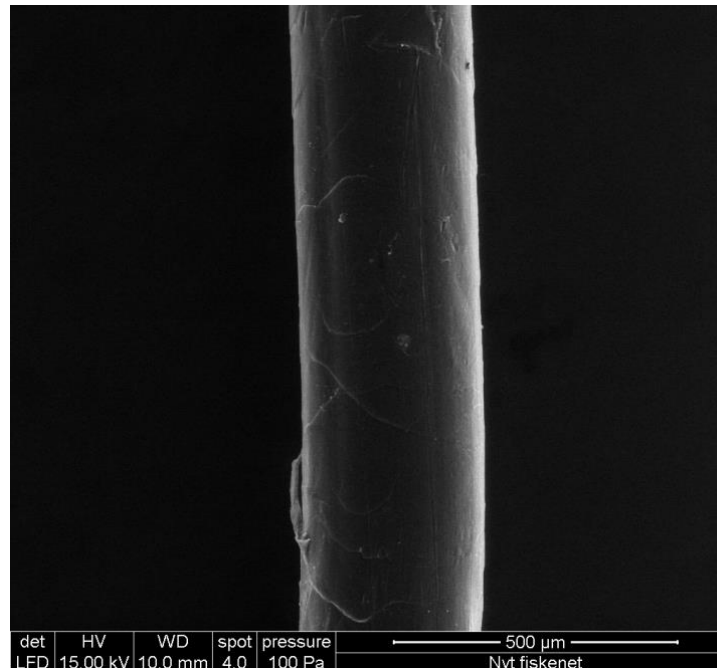


MSc project: Simon J. Svensson (2016)

PE fibres from fishing nets

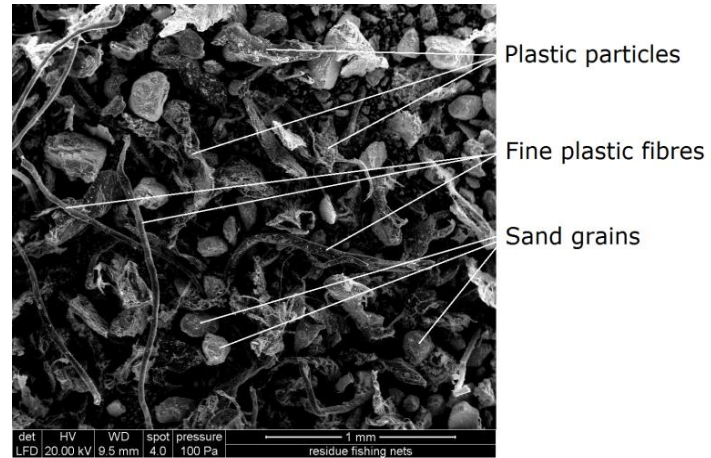


- Recycled PE fibres from waste fishing nets processed at Plastix A/S, Denmark
- Mechanical cutting operation → different fibre lengths



PE fibres from fishing nets

- Impurities (mix of sand, micro plastic etc.) washed out of the fibres

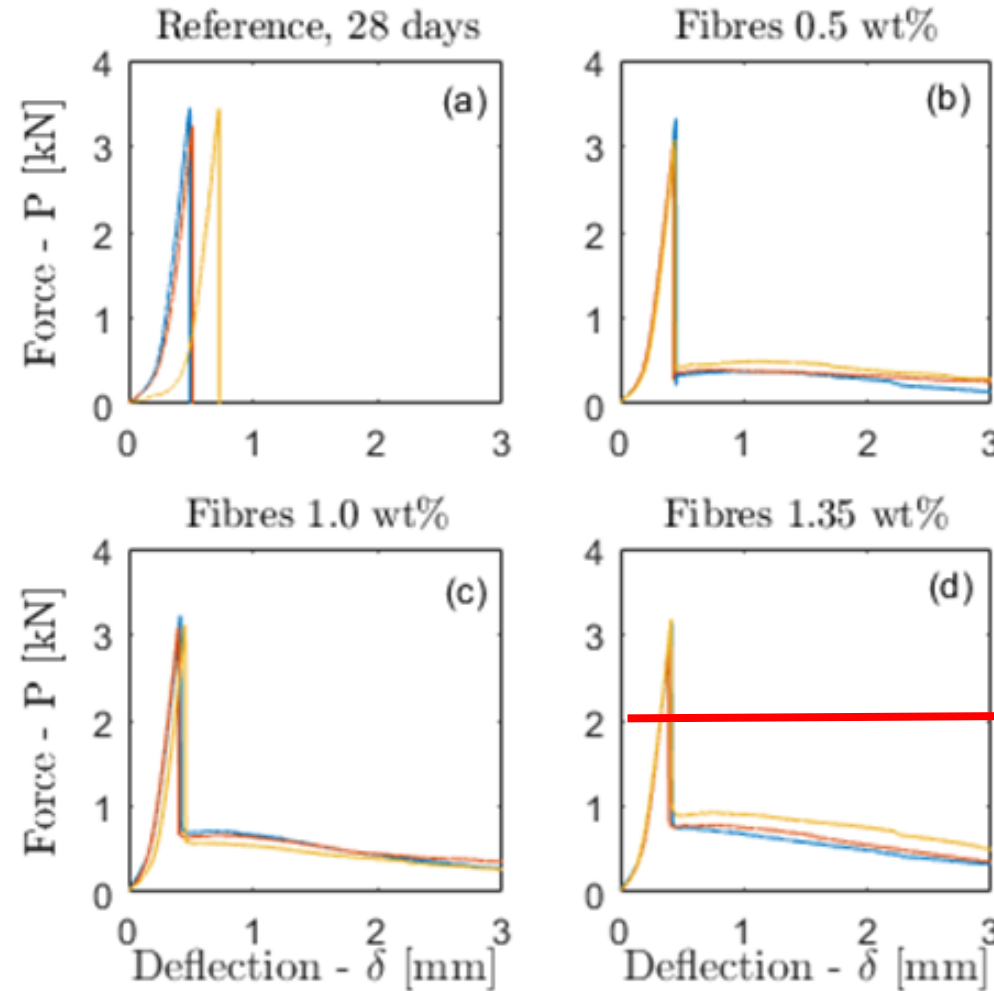


- Fibres ready to being mixed into construction materials



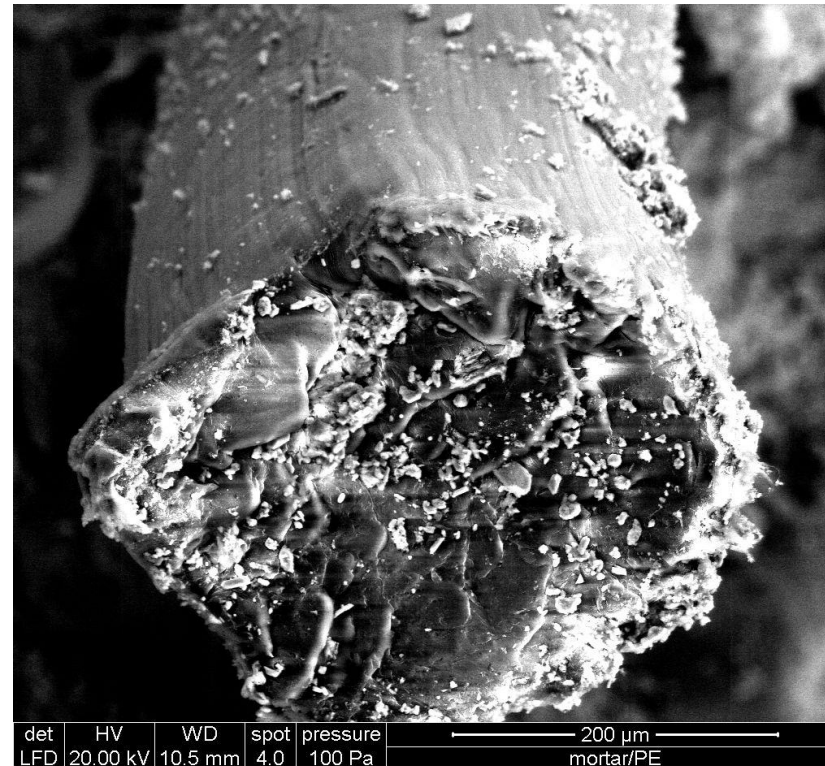
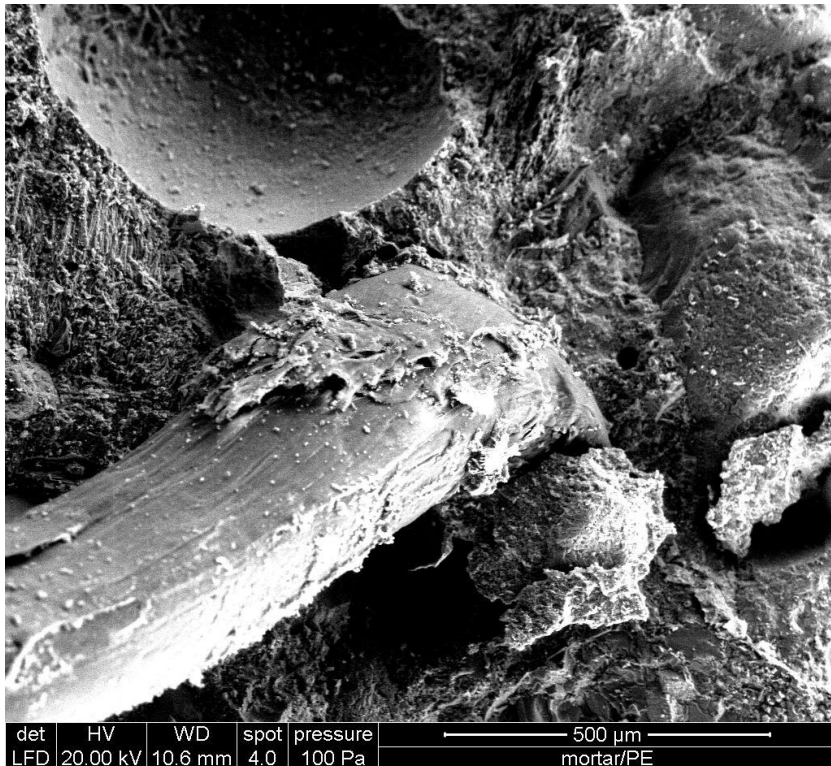


Structural purpose - flexural strength. PE fibers



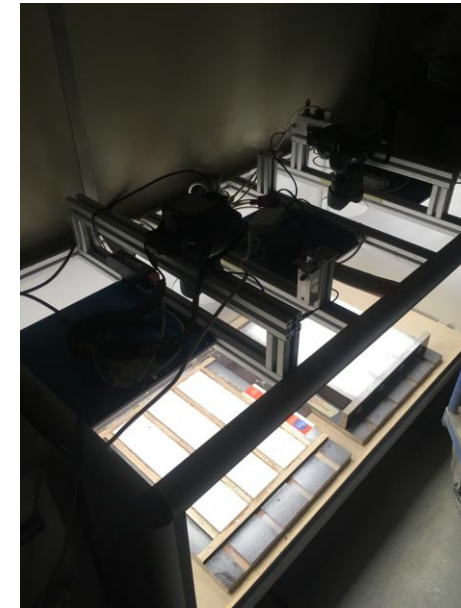
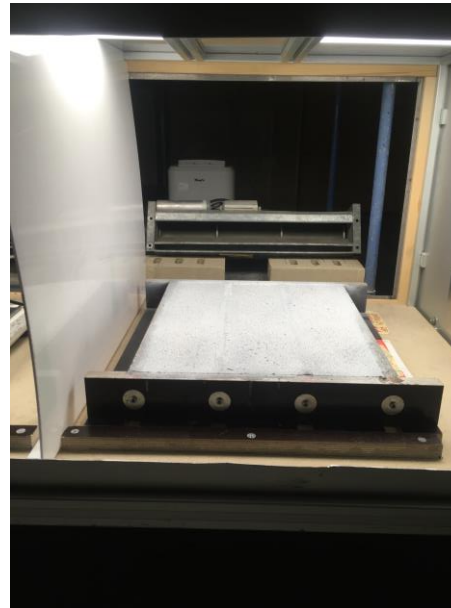
Fibre in cement matrix

- Analysis of crack-surface of fibre reinforced mortar
- Long-term deterioration of fibres in cement



Plastic shrinkage cracking

- Testing mortar specimens with and without fibres under controlled environmental conditions in laboratory (temp., humidity, wind)
- Method: Casting on top of rough concrete block to “restrain” the fresh mortar overlay
The overlay cracks when no fibres are added, so we can examine the effect of fibres



Plastic shrinkage cracking

- Taking pictures of the surface to evaluate the crack development
- Plastic shrinkage cracking occurs in the first few hours after casting

1 h after casting



25 hours after casting

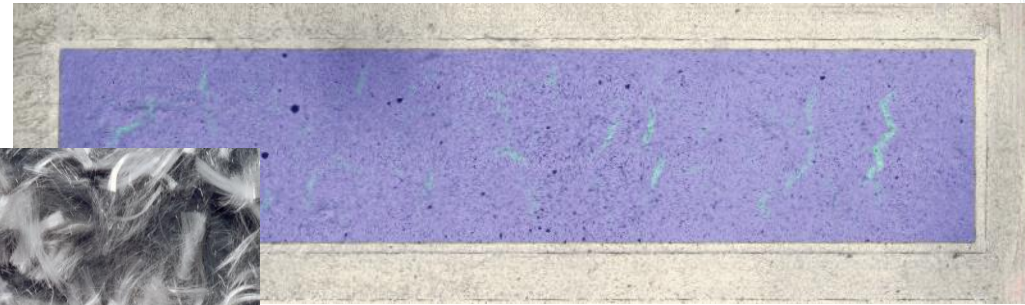
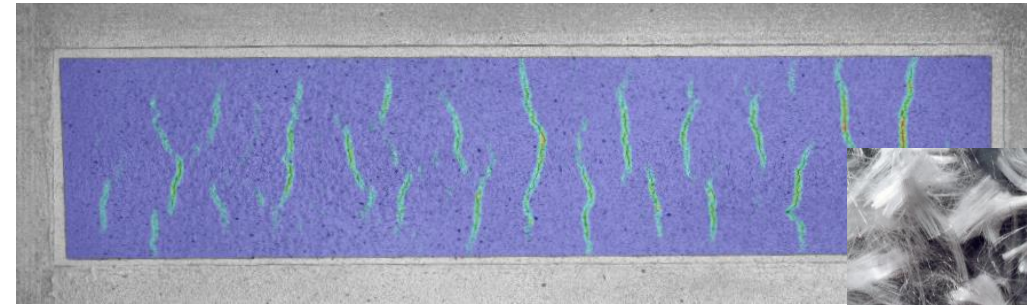


Plastic shrinkage cracking

Major strain (%) = Relative displacement

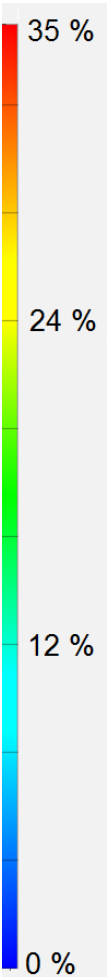
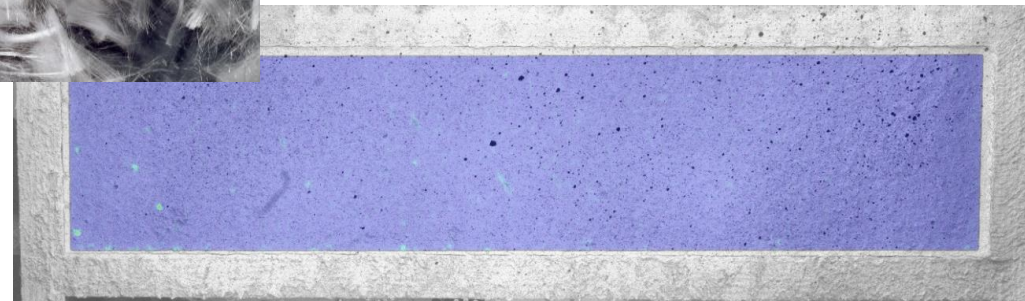
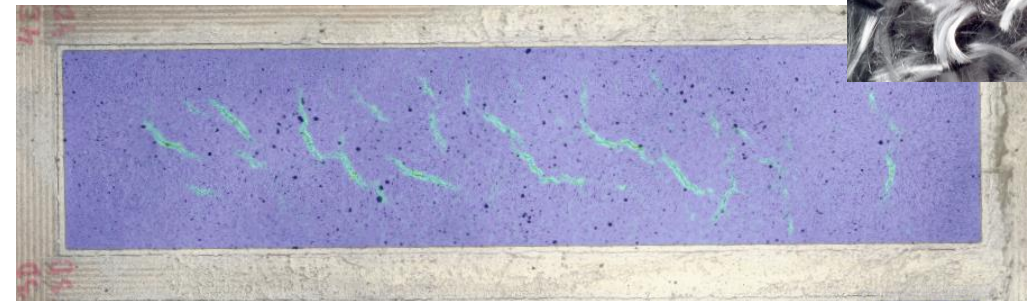
Reference (no fibres)

2 % of PE fibres



1 % of PE fibres

PE fibres



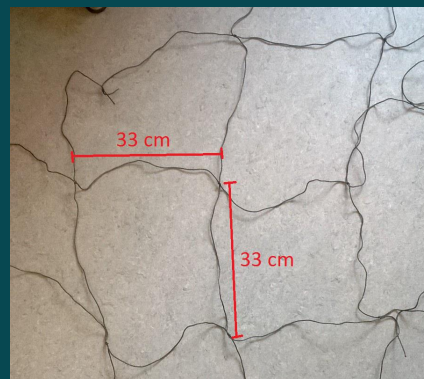
Recapitulation/take home message

PE from mixed nets



For **durability** purposes - control of plastic **shrinkage** cracking

Nylon 6 cut from one net



For **structural** purposes – improvement of mechanical properties

What's next?

- Durability of Nylon 6 in concrete?
- Degradation of nets in the waste dump and influence on mechanical properties?
- Pilot testing in the NPA region and long term monitoring of effects
- Collaboration with concrete industry on recipe for use in constructions



Collaboration with Green Tech College, Sisimiut

Thank you for your
attention 😊





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