



Universidad
Politécnica
de Cartagena



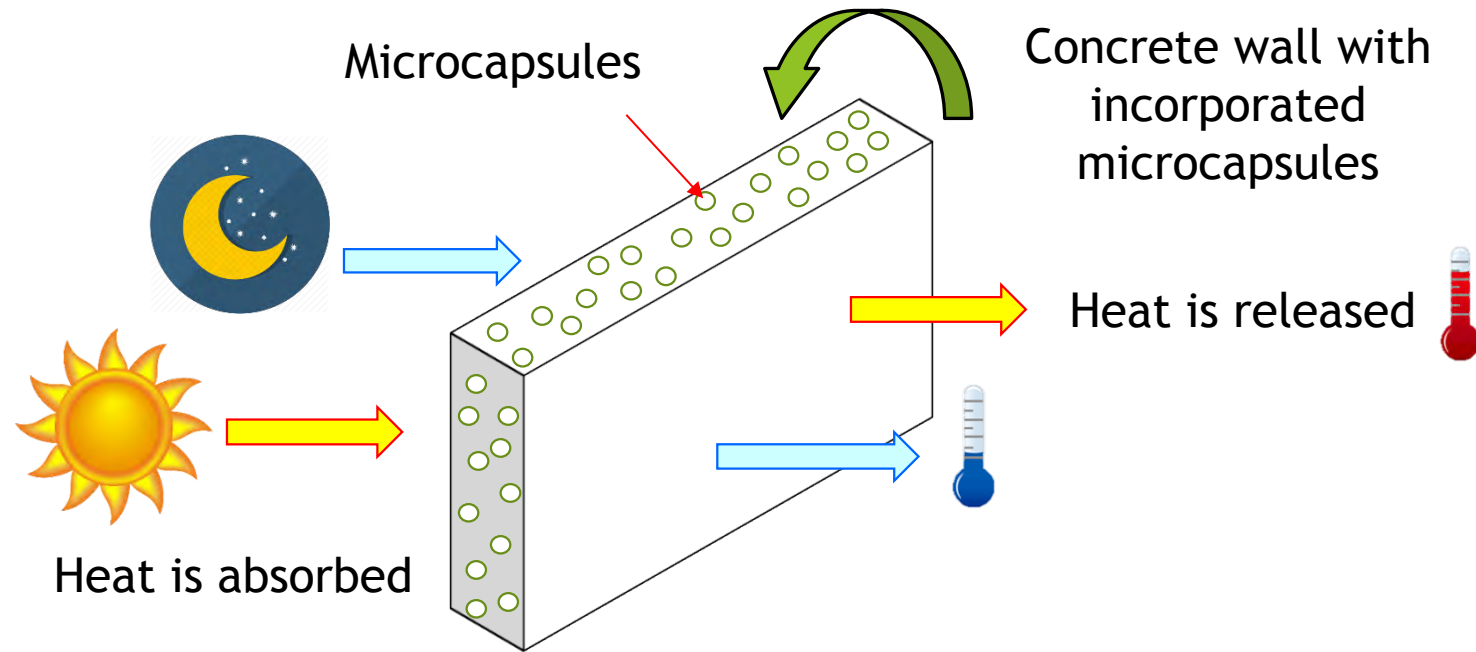
Østfold University College

Investigating the mechanical properties of geopolymer concrete with incorporated micro-encapsulated phase change materials

Shima Pilehvar

Shima.pilehvar@hiof.no

Purpose of adding Micro-encapsulated Phase Change Material to building materials



Saving excess solar energy during the day by melting
Releasing the stored heat into the environment at night by solidifying

Concrete with incorporated micro-encapsulated phase change materials

Advantage

- ▶ Increasing the heat storage capacity of concrete
→ control energy saving

Disadvantage

- ▶ Reducing mechanical properties such as compressive strength



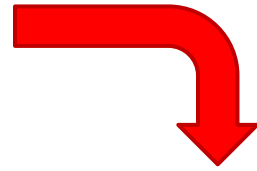
Two different types of micro-encapsulated phase change materials



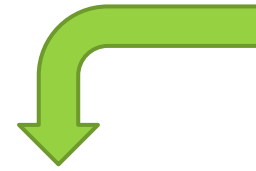
Polymers
as shell



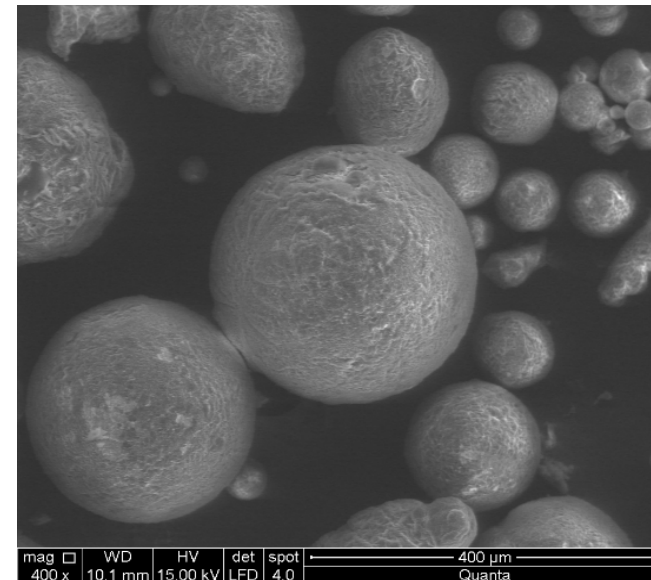
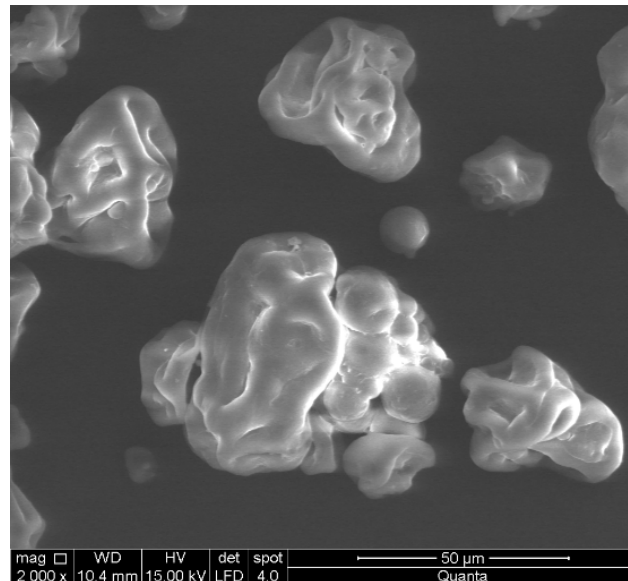
Parrafin wax
as core



A1



A2



Geopolymer concrete mixture

- ▶ Alkaline Solution : NaOH and Na_2SiO_3
- ▶ Fly ash class F
- ▶ Slag
- ▶ Sand
- ▶ gravel
- ▶ Extra water
- ▶ Superplasticizer
- ▶ 2 different MPCMs (A1 and A2)



Experimental procedure

GPC



PCC



Mixing



Slump test



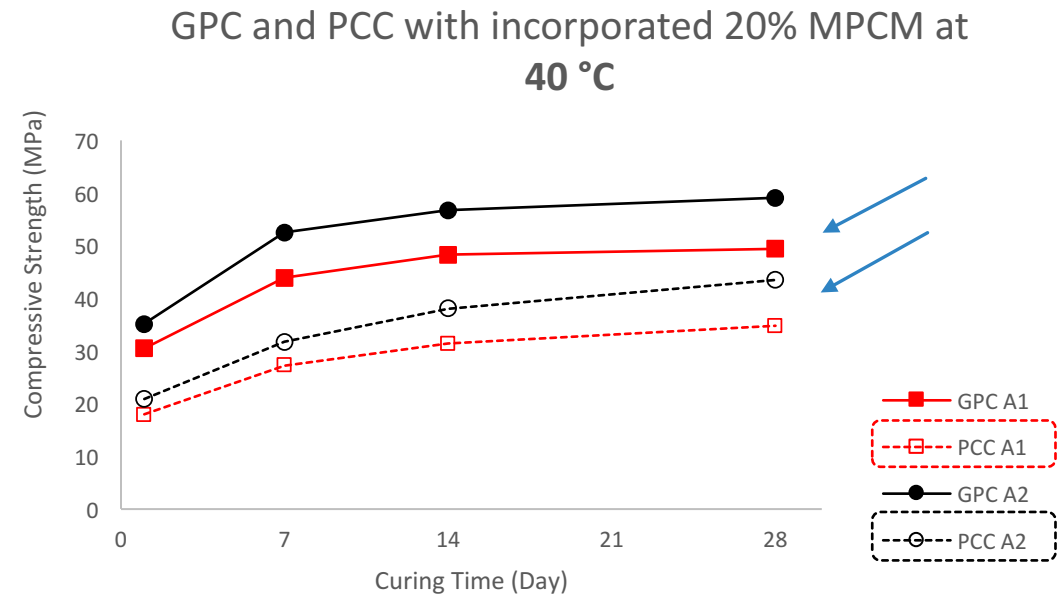
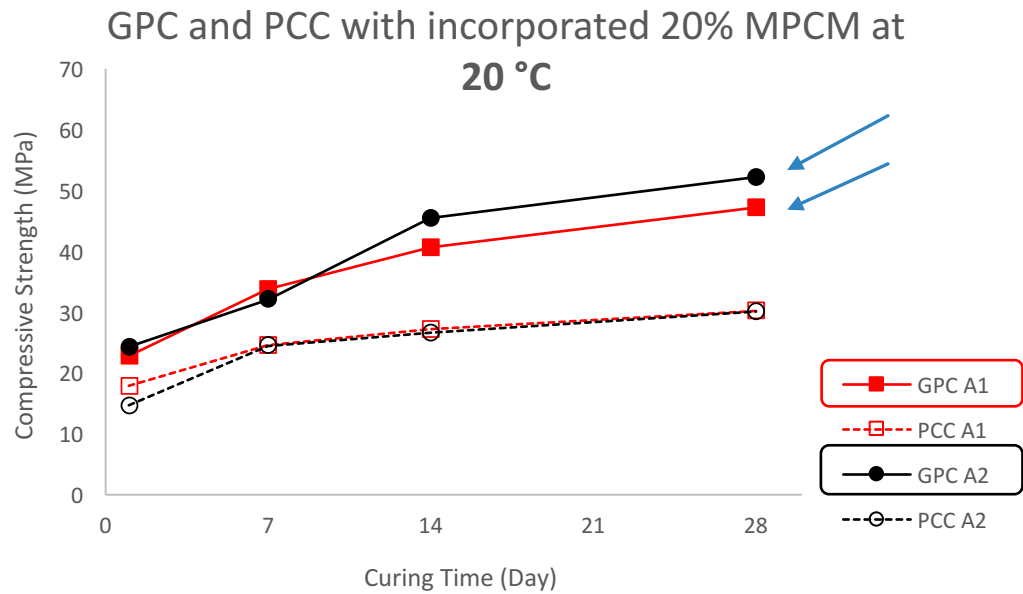
Curing at 20 °C and 40 °C for 28 days



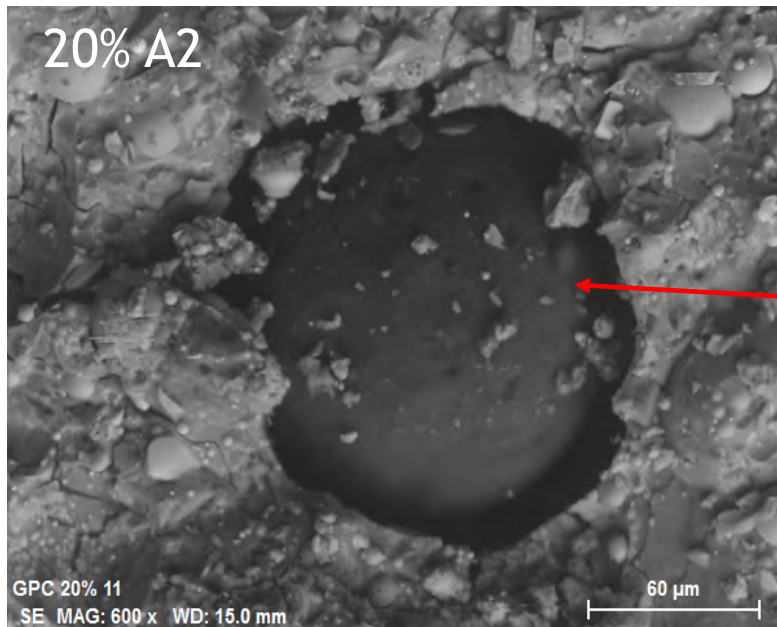
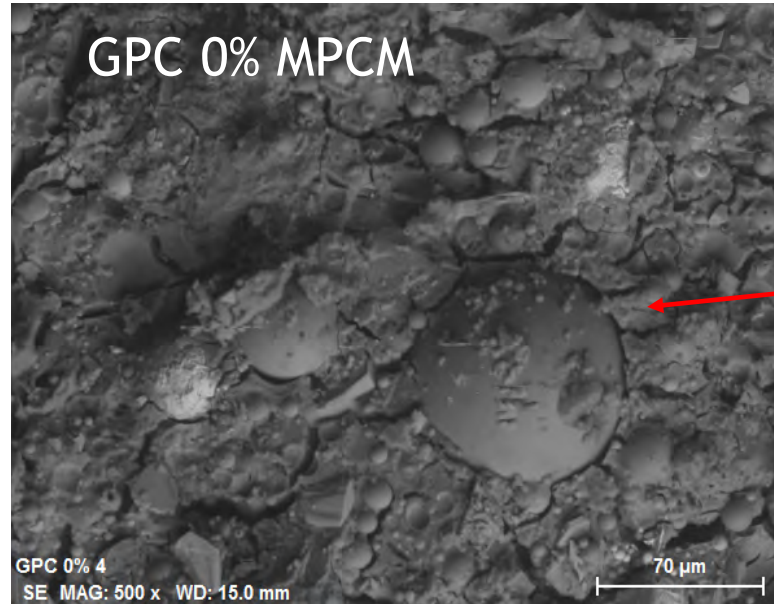
Measuring compressive strength



Compressive Strength of Geopolymer concrete and Portland Cement concrete



SEM images of GPC with incorporated MPCM



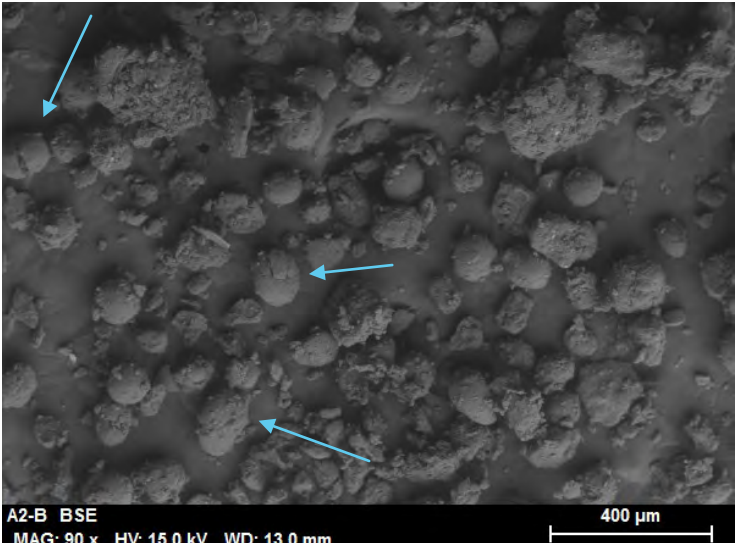
Hypotheses for the strength reduction of concrete after adding microcapsules



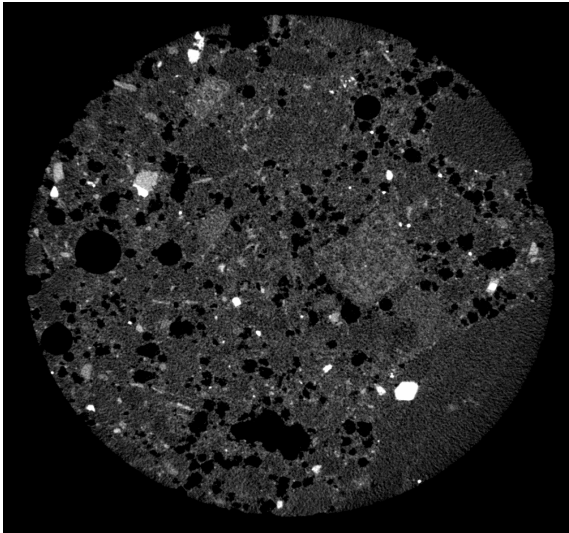
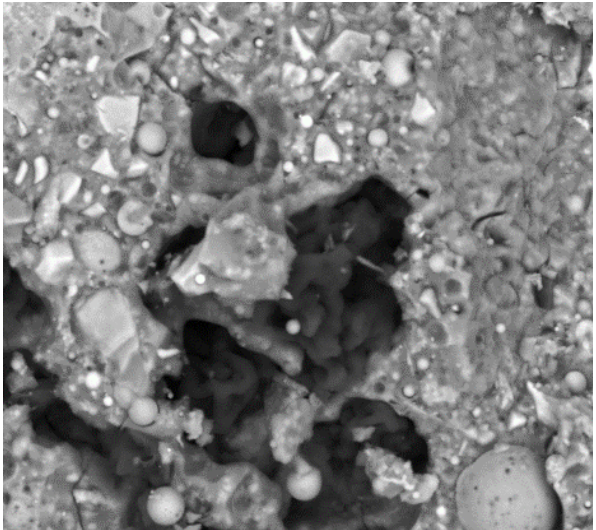
Low stiffness and difference in PSD of MPCM compared to sand



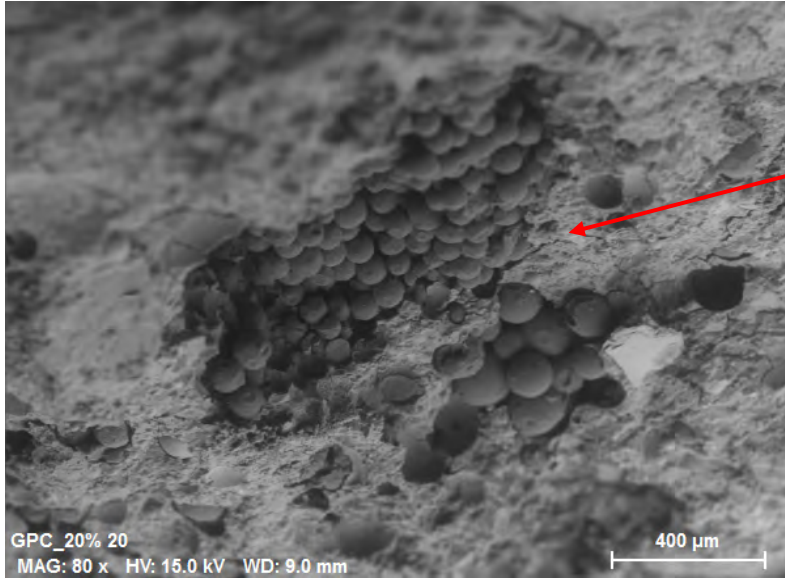
Breaking the MPCM during mixing or measurement



Microscale effects of MPCM on the concrete matrix



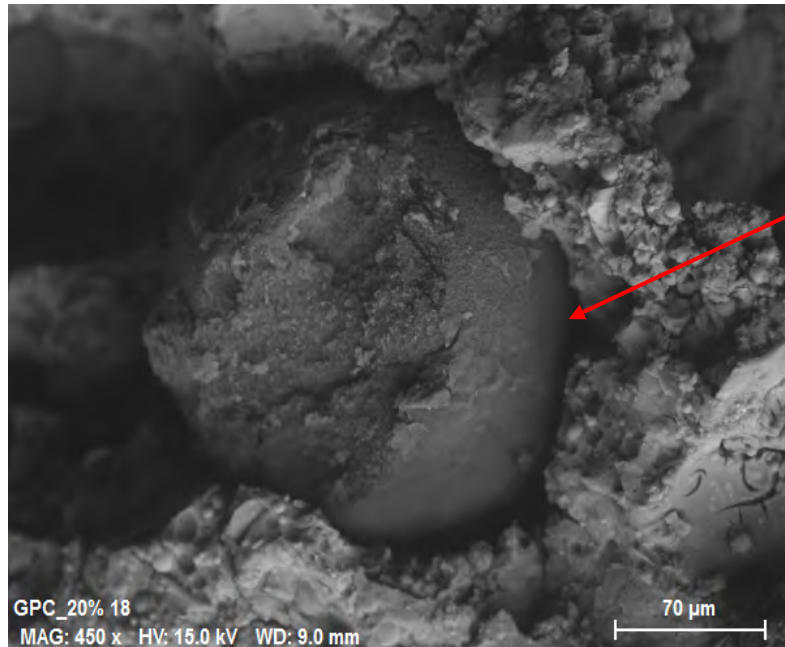
Some reasons of the strength reduction in microscale



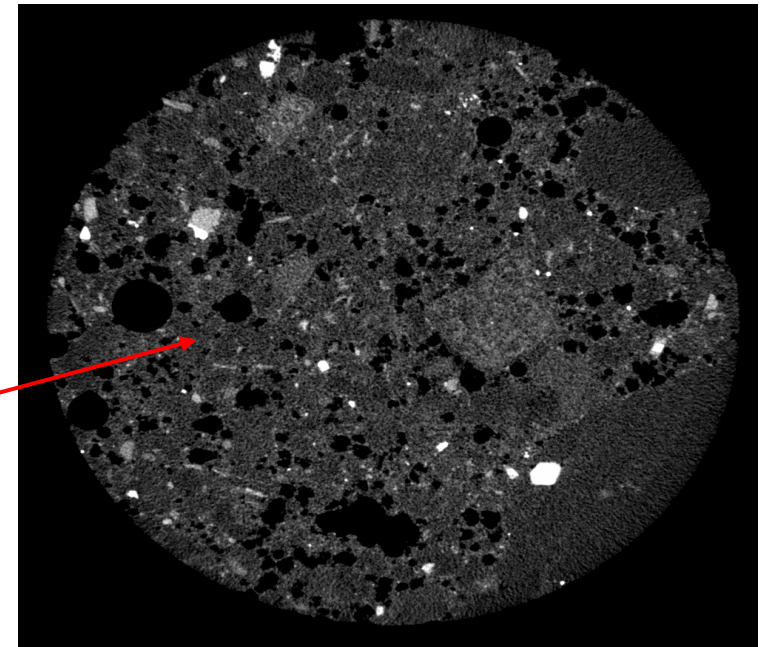
Agglomeration of MPCM



Poor bond and gap between GPC matrix and MPCM



Broken shell of MPCM and leakage of paraffin into the GPC matrix after mixing



Acting like porosity



Thank you for attention