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RELATIONSHIP BETWEEN MECHANICAL PROPERTIES AND CONDUCTIVITY OF SCC MIXTURES WITH STEEL FIBRES

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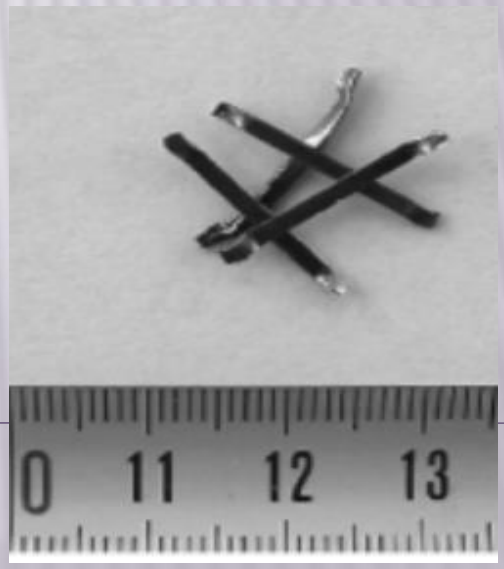
MOTIVATION

- Evaluation of methods for SFRC resistance against aggressive agents penetration.
- Comparison with mechanical properties.



INTRODUCTION

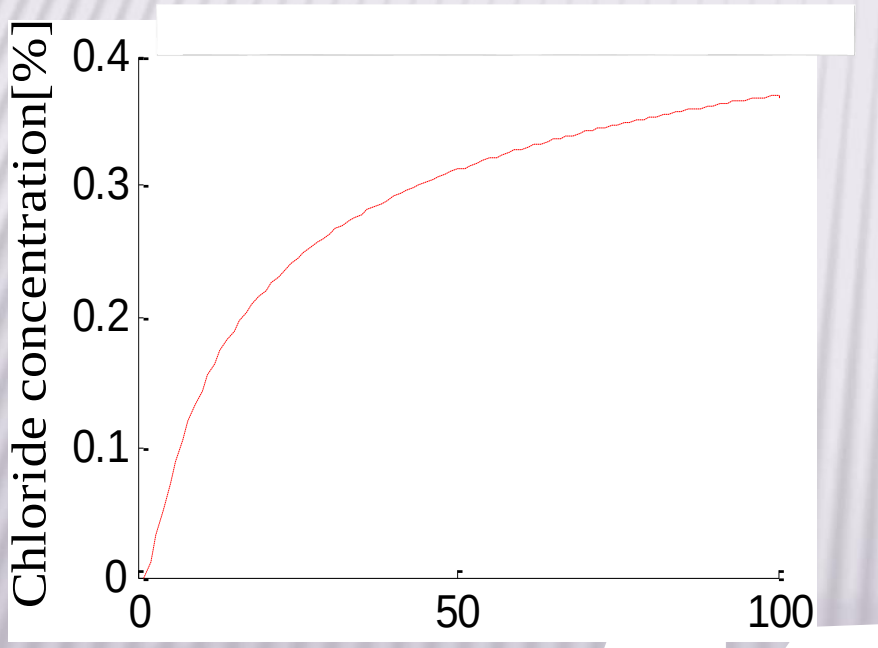
- Durability of RC bridge structures in Central Europe is reduced by steel reinforcement corrosion.

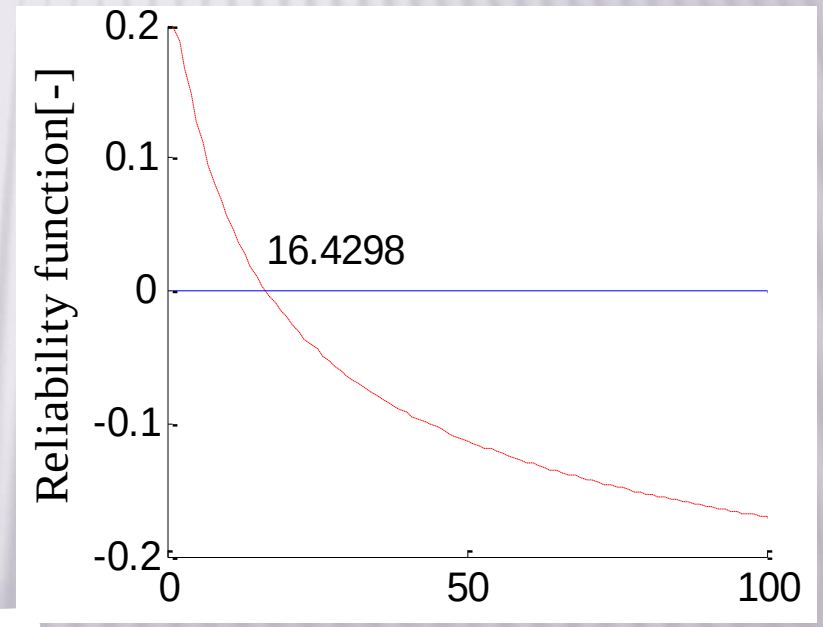
- Corrosion of steel reinforcement

- Modelling of degradation via chloride penetration assessment

MODELING OF CORROSION INITIATION

- Differential equation for diffusion of chlorides (2nd Fick's Law solution):





Lehner, P., Konečný, P. (2015). Durability assessment of concrete bridge deck considering waterproof membrane and epoxy-coated reinforcement. Perspective in Science. Vol. 7, pp.222-226.

GOALS

- Comparison of three methods of evaluating concrete ability to resist chlorides:
  - **resistivity test,**
  - bulk diffusion test and
  - rapid chloride permeability test (RCPT).
- Basic insight into the material background in laboratory at SUT Gliwice Erasmus+ Training program:

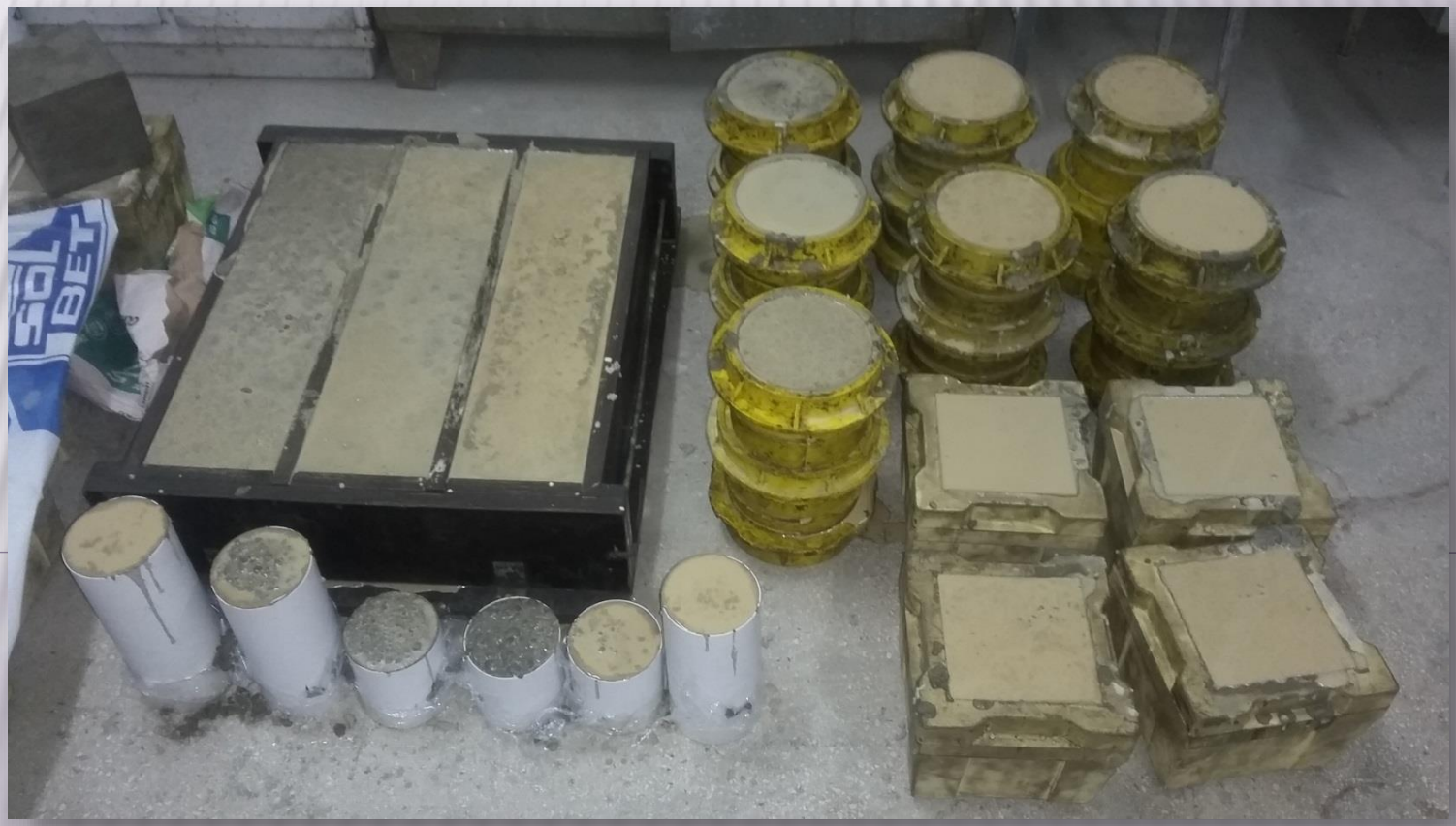
MIXTURE COMPOSITE

Mixture No.	OPC	SCC 0%	SCC 1%	SCC 2%
Cement type I 42.5 R	313 kg/m^3	490 kg/m^3		
Water	164 kg/m^3	201 kg/m^3		
Sand	287 kg/m^3	807 kg/m^3		
River gravel	1546 kg/m^3	807 kg/m^3		
Superplastificator Glenium sky	-	12.25 kg/m^3		
Stabilizator RheoMatrix	-	1.96 kg/m^3		
Steel Fibres KE20/1.7	-	-	80 kg/m^3	160 kg/m^3
Water/cement ratio (W/C)	0.52	0.41		

CONCRETE SPECIMENS

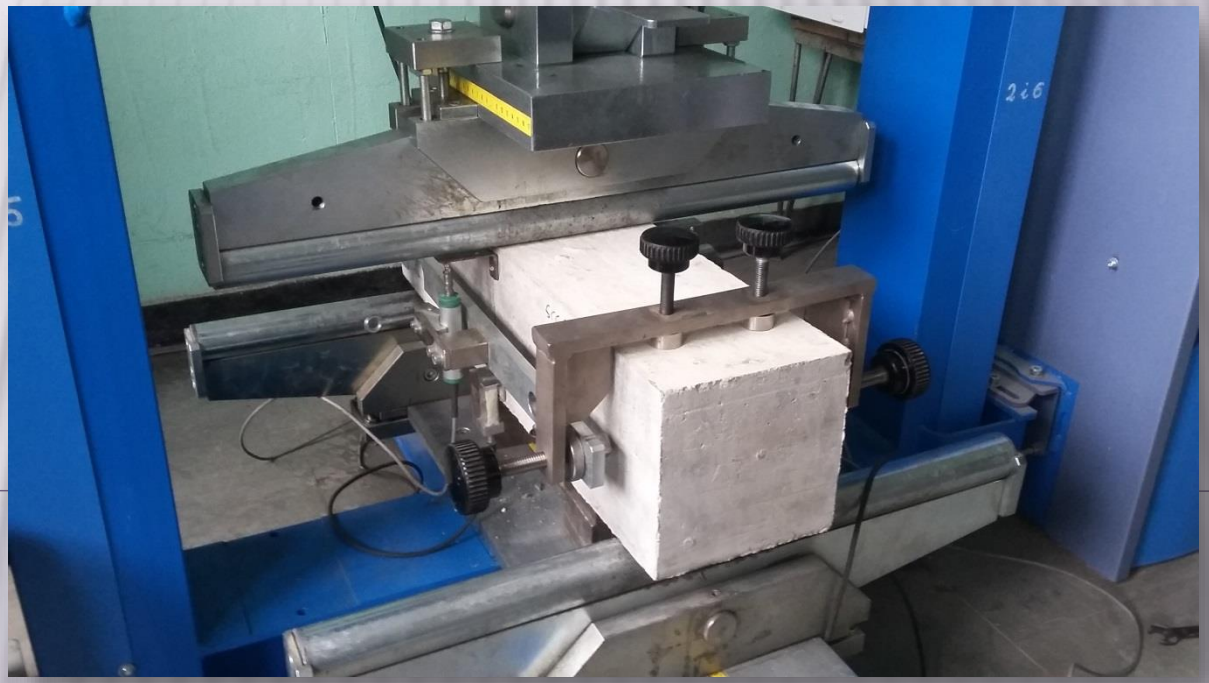
Four sets of concrete mixtures:

- reference Classic Portland Cement (SPC) concrete,
- self-compacting concrete (SCC),
- SCC with 1% of fibres,
- SCC with 2% of fibres.



ELEMENTARY TESTING

- Stress strenght of concrete on cylinders and cubes,
- modulus of elasticity on cylinders,
- tensile splitting strength of concrete on cylinders,
- three-point Tensile bending strength of concrete on beams.

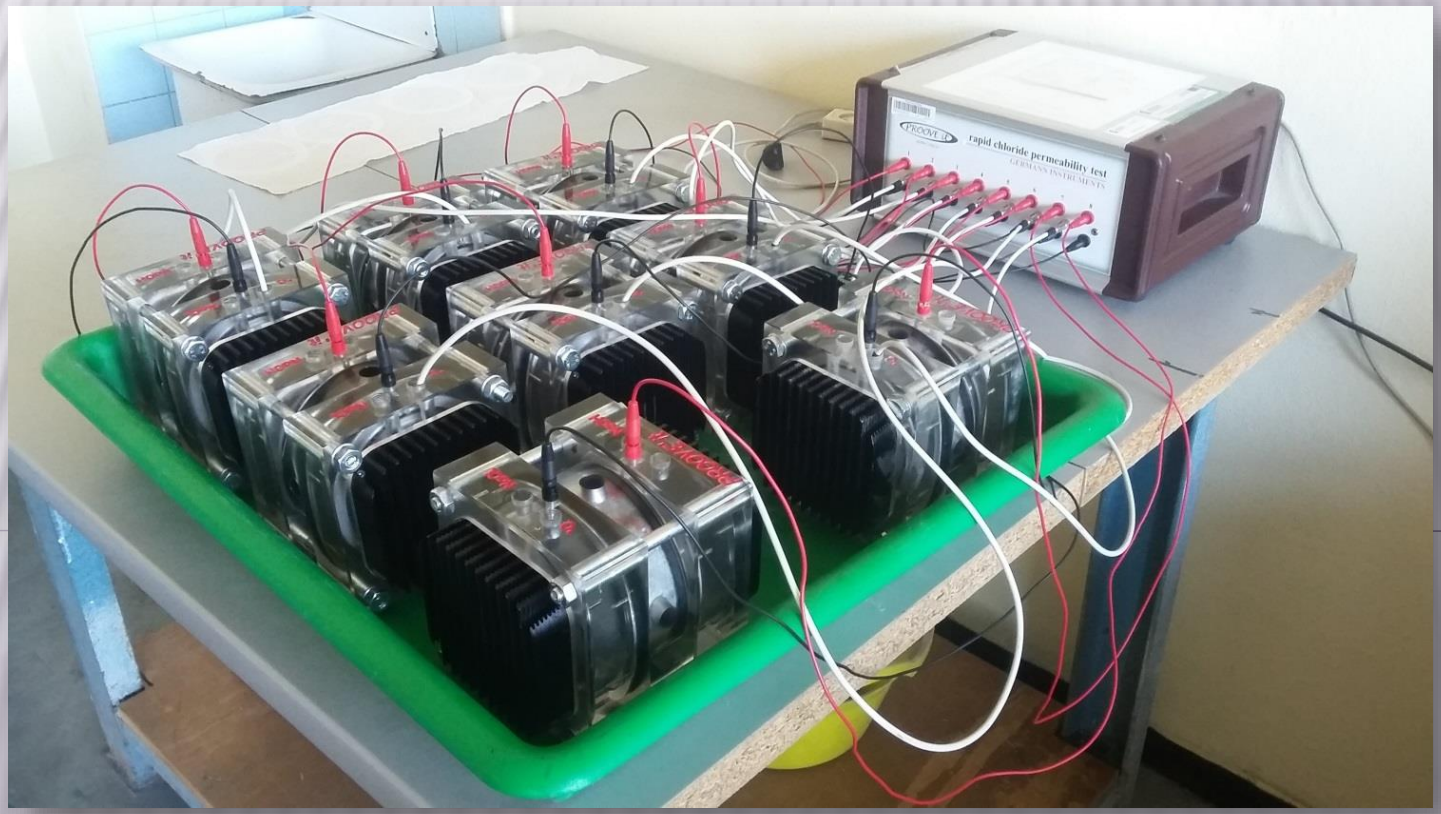


ELECTRICAL PROPERTIES

Measurement of electrical resistivity is the surface measurement using Wenner probe.
Age when tested 7, 14, 28, 56, 91 and 161 days.

RAPID CHLORIDE PERMEABILITY

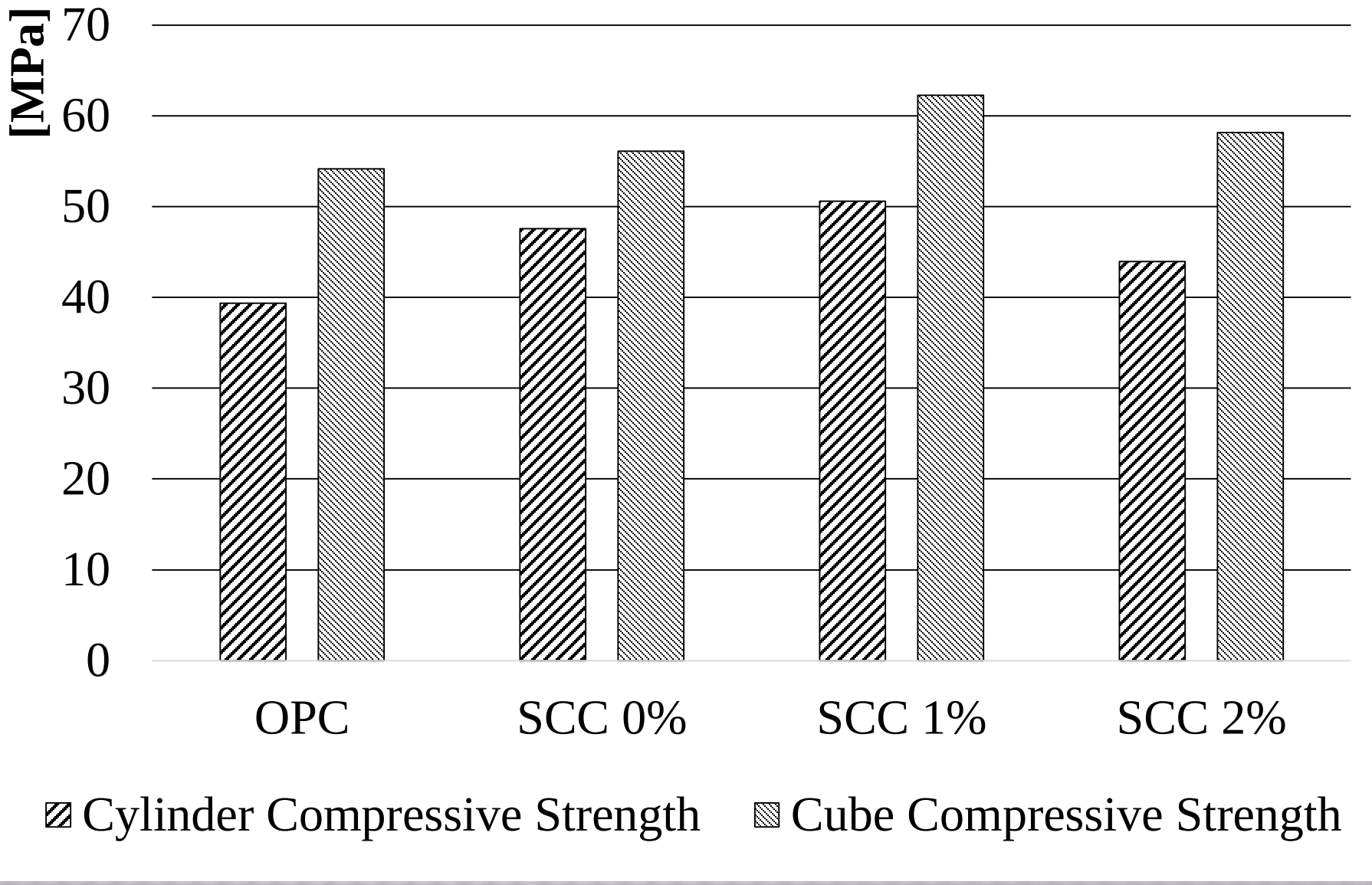
The RCPT is performed by monitoring the amount of electrical current that passes through a sample 50 mm thick by 100 mm in diameter in 6 hours This sample is typically cut as a slice of a core or cylinder. A voltage of 60V DC is maintained across the ends of the sample throughout the test. One lead is immersed in a 3.0% salt (NaCl) solution and the other in a 0.3 M sodium hydroxide (NaOH) solution.



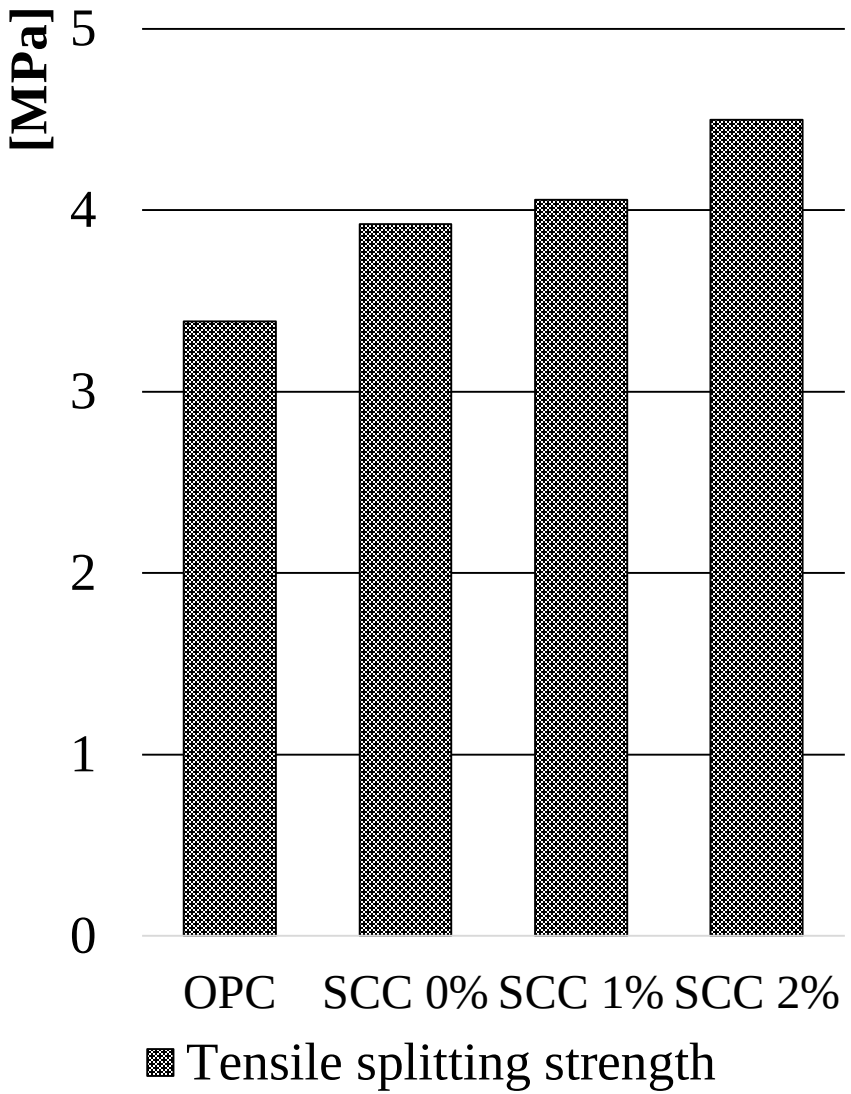
NORDTEST NTBUILD 443

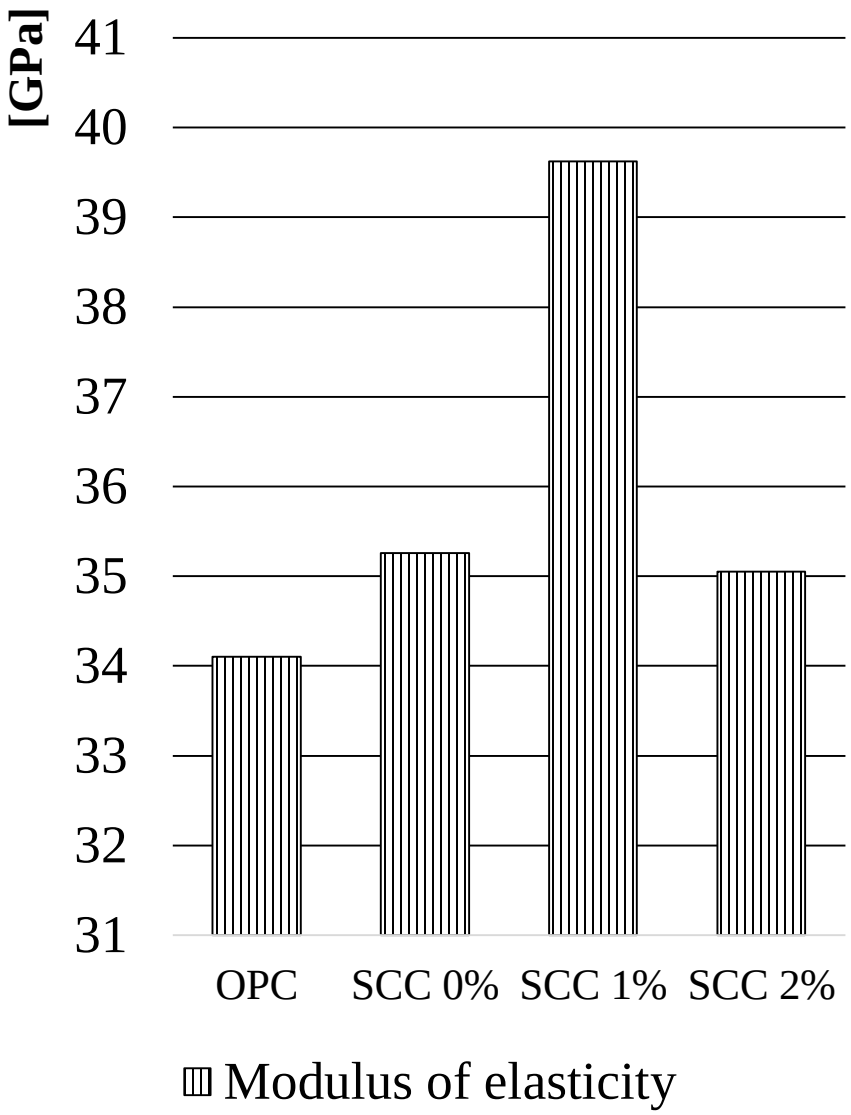
A bulk diffusion test has been developed to overcome some of the deficiencies of the salt ponding test to measure diffusion. Though not the first similar test developed, the NordTest is the first formally standardized version of the bulk diffusion test.

ELEMENTARY TESTING

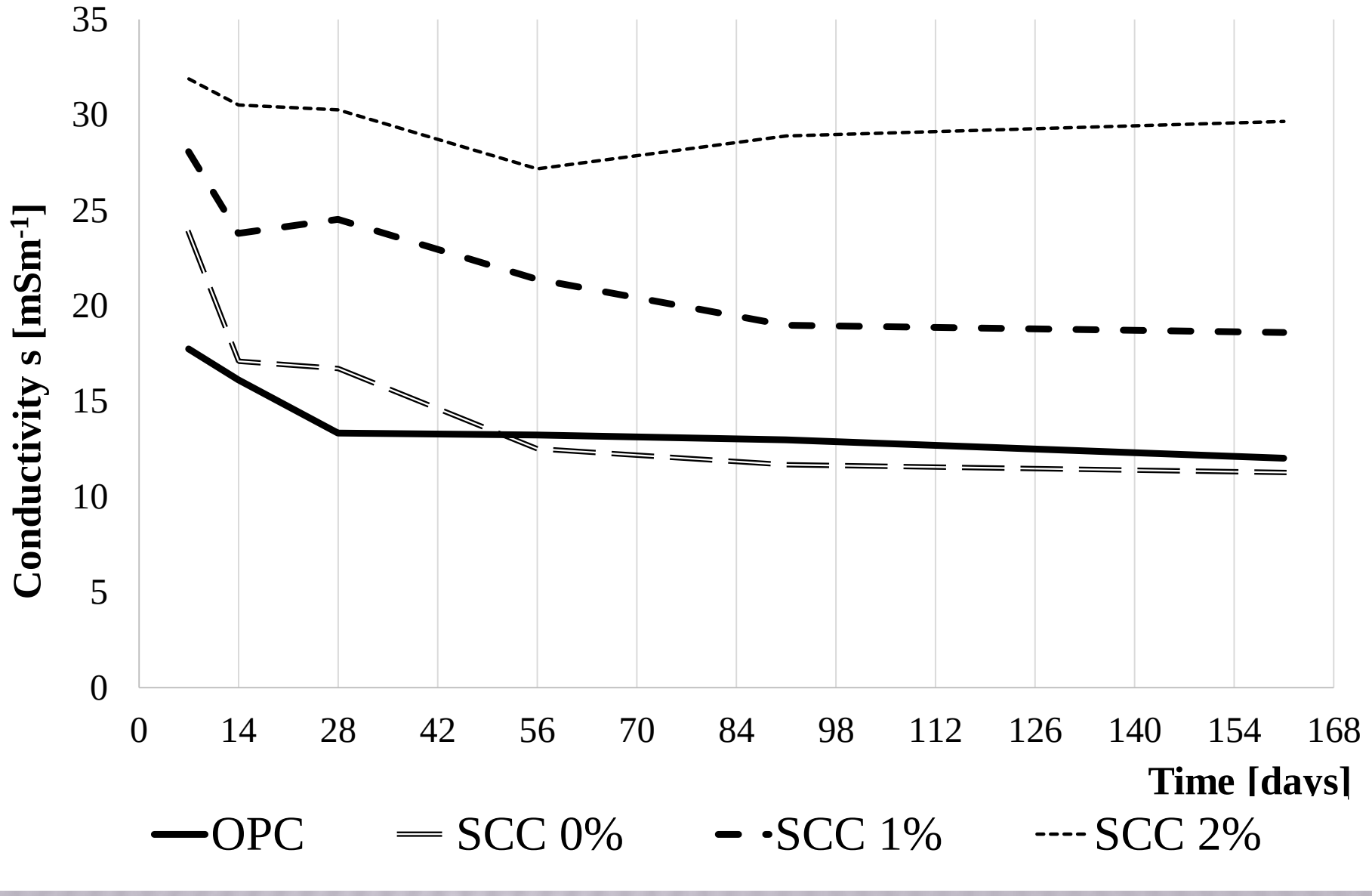


ELEMENTARY TESTING

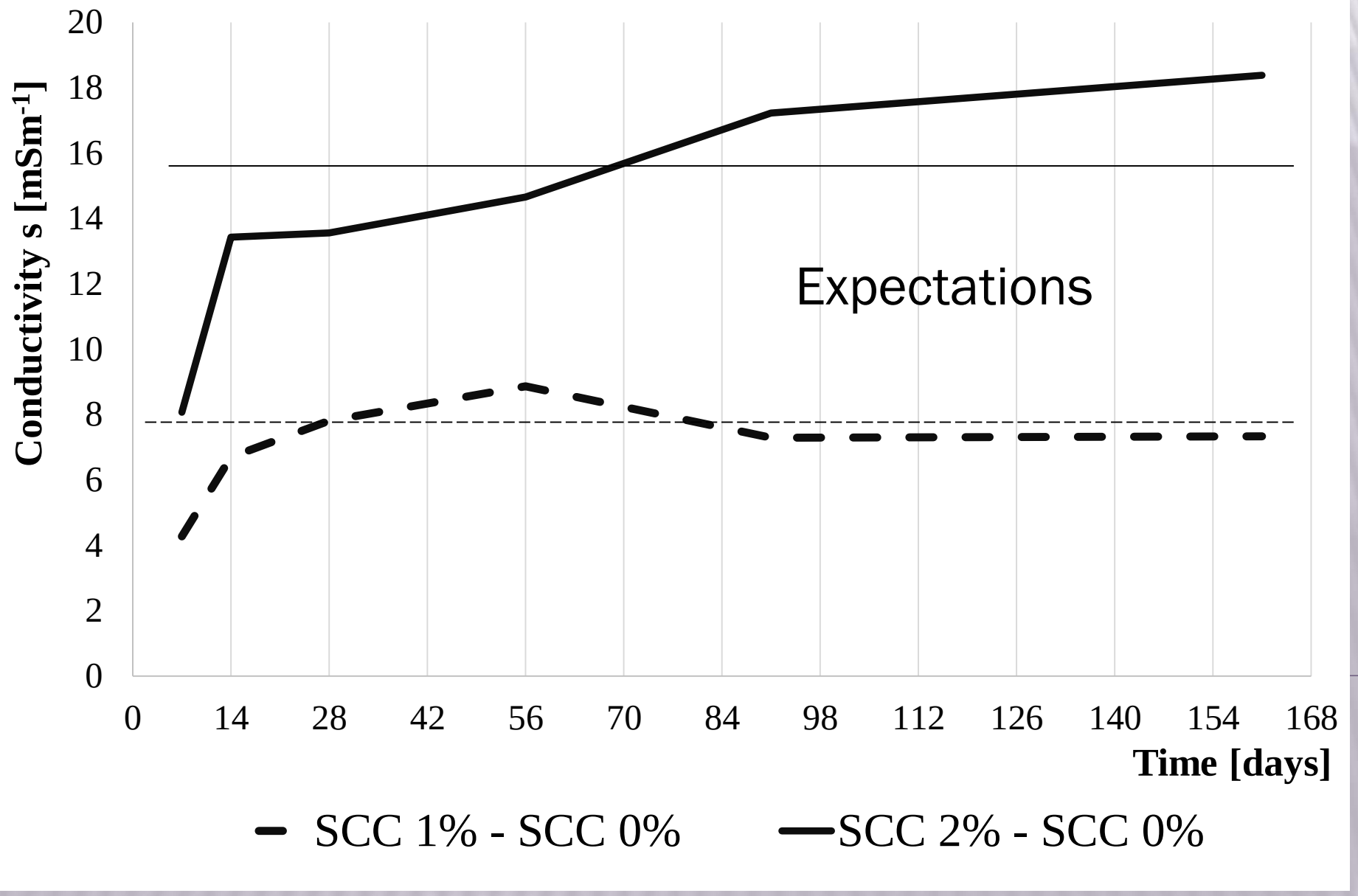




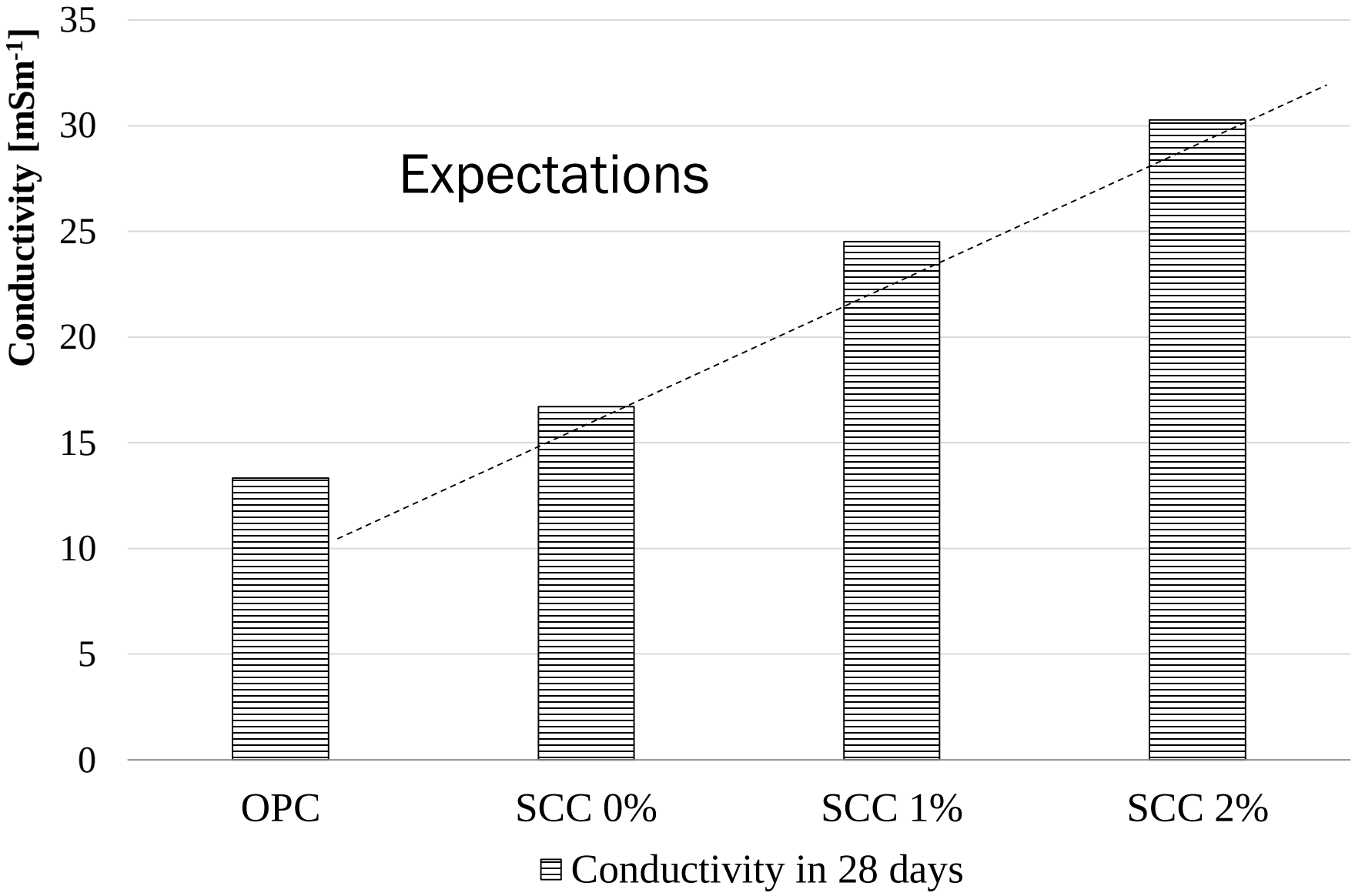
CONDUCTIVITY



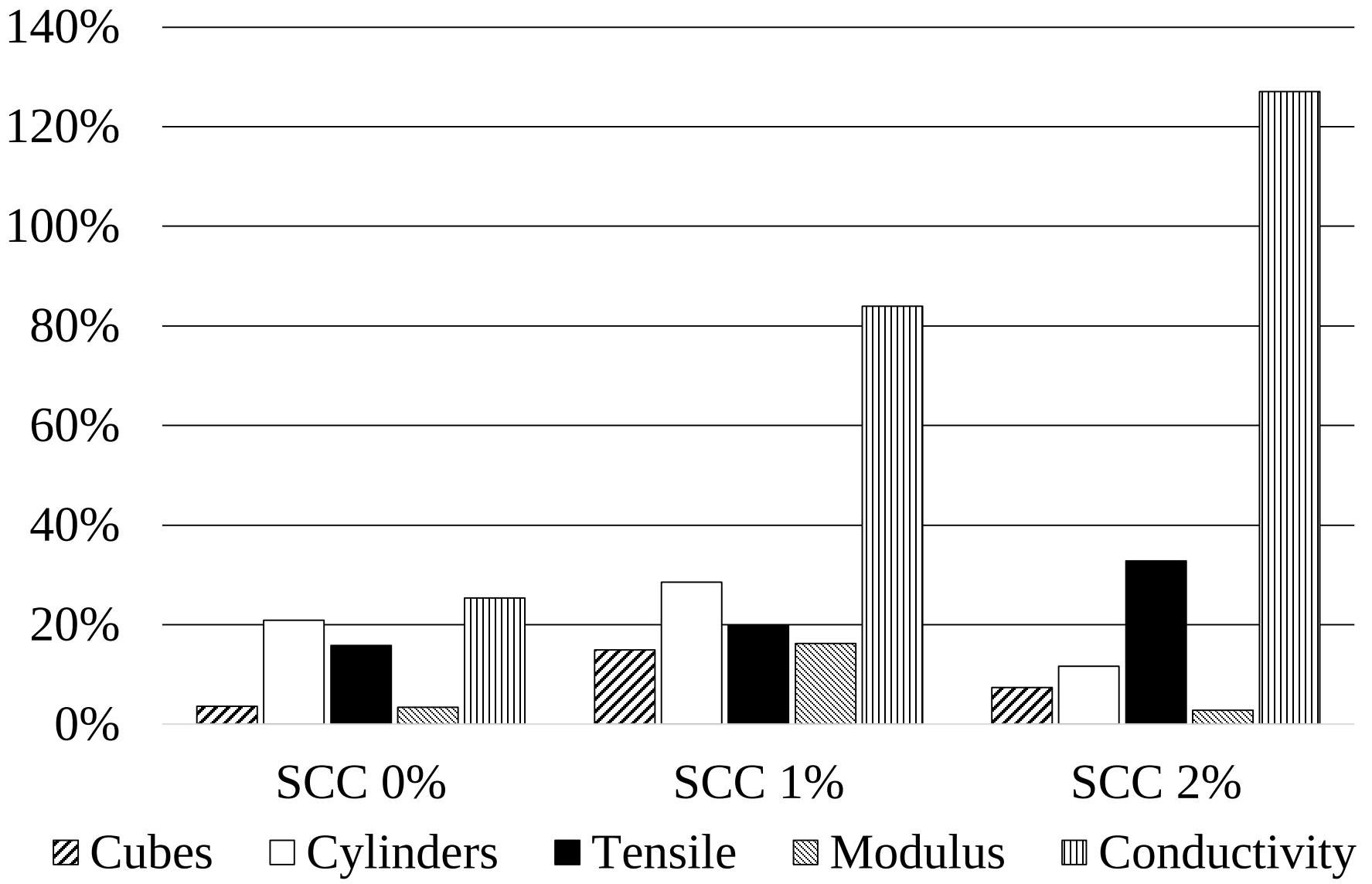
CONDUCTIVITY OF STEEL FIBRES



CONDUCTIVITY 28 DAYS



COMPARISON OF PROPERTIES



CONCLUSIONS

- There was correlation between the amount of steel fibres and conductivity – not linear in time.
- A decrease of mechanical properties of SCC 2% was observed – excluding tensile splitting strength.
- The presented results are part of a campaign that includes another electrochemical tests.