MECHANICAL PROPERTIES OF ALKALI-ACTIVATED MATERIALS BASED ON BLAST FURNACE SLAG AND CALCIUM SULPHATE DIHYDRATE

Katrijn GIJBELS[1], Yiannis PONTIKES[2], Remus Ion IACOBESCU[2], Sonja SCHREURS[1], Wouter SCHROEYERS[1]

[1] Hasselt University, CMK, Nuclear Technology Centre (NuTeC), Faculty of Engineering Technology, Agoralaan, 3590 Diepenbeek, Belgium

[2] KU Leuven, Department of Materials Engineering, Kasteelpark Arenberg 44, 3001 Leuven, Belgium

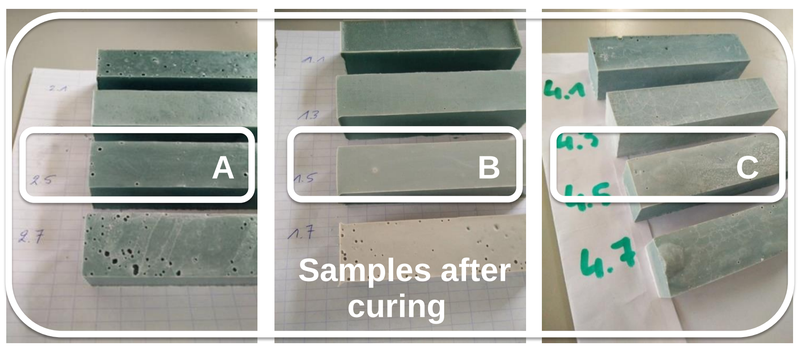
Introduction

Alkali-activated materials (AAMs) are currently under research for providing opportunities for re-use of industrial residue streams in the construction sector. Ground granulated blast furnace slag (GGBFS), an excellent precursor for AAMs, is used in a wide range of applications[1], in which some of these contain a significant amount of sulphate (e.g. flue gas desulfurisation gypsum)[2]. For this reason, GGBFS-based AAMs serve here as a test matrix in order to allow the incorporation of sulphate-rich residues, aiming to investigate the influence of curing temperature on the mechanical properties of AAMs, focussing solely on pastes based on GGBFS and calcium sulphate dihydrate (CS).

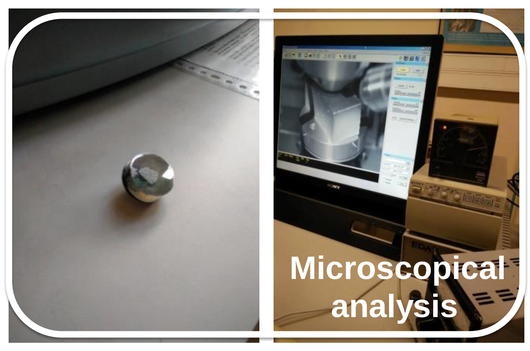
Experimental procedure

	H_2O/Na_2O	SiO_2/Na_2O	GGBFS (g)	CS (g)	Curing for the first 24h	L/S
Reference	20	2	50	0	20 °C	0.4
Sample A	20	2	45	5	20 °C	0.6
Sample B	20	2	45	5	60 °C	0.6
Sample C	20	2	45	5	80 °C	0.6

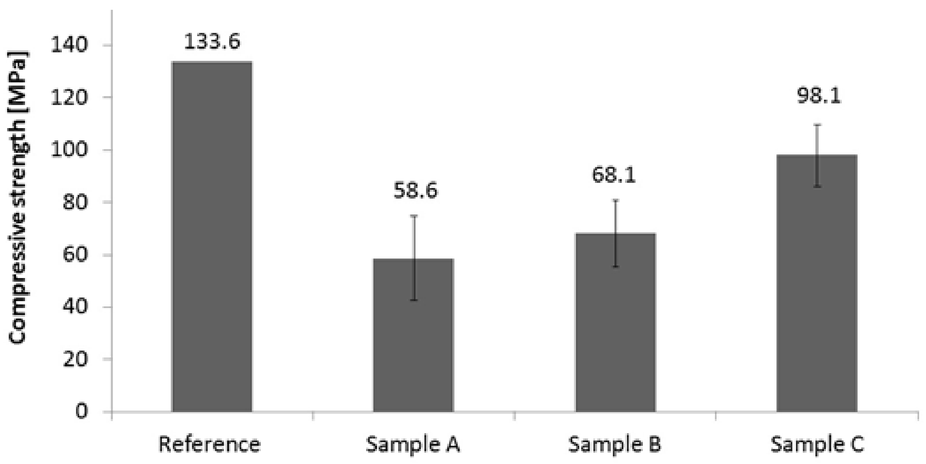
28 days of curing

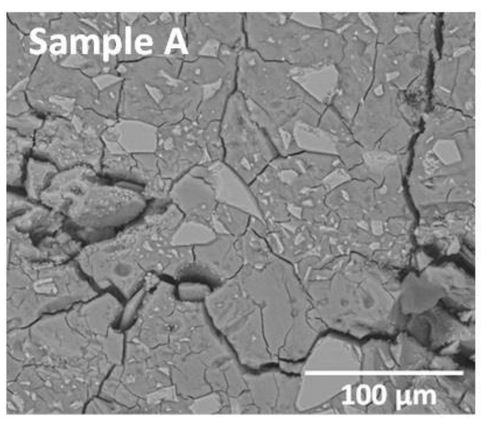


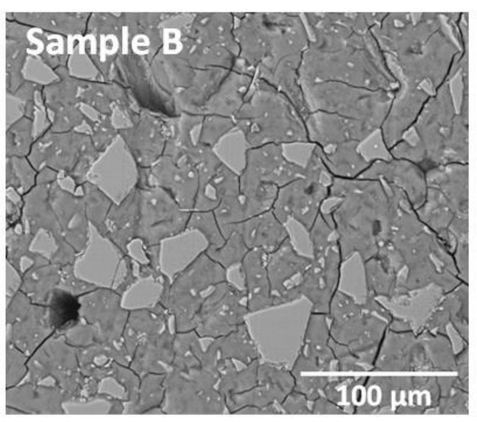
Testing and characterisation

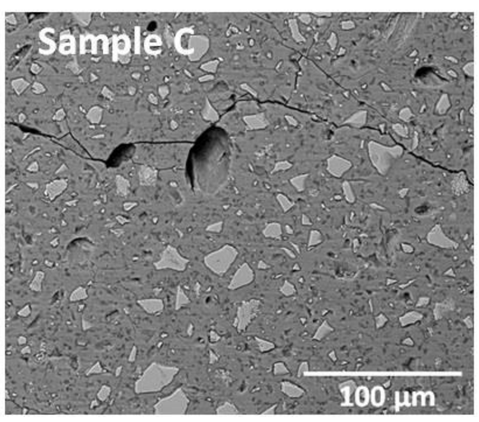


Results









Conclusions

The influence of curing temperature (i.e. 20, 60, and 80° C) on the mechanical properties of AAM pastes made from 90 wt% GGBFS and 10 wt% CS as precursors was investigated. Compared to the reference sample (100 wt% GGBFS), addition of CS resulted in a decrease in strength; however, by increasing the curing temperature the strength increased. SEM microscopical observation indicated a denser microstructure with less microcracks for curing at 80° C compared to curing at lower temperatures (i.e. 20 and 60° C). This is attributed most likely to the faster kinetics taking place with respect to polymerisation and strength gain for the matrix, and is the main reason for the high compressive strength demonstrated.

References

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[2] M. Marroccoli, M. Nobili, A. Telesca and G.L. Valenti, “Early hydration of calcium sulfoaluminate-based cements for structural applications”, in *International Conference on Sustainable Construction Materials and Technologies*. Coventry, England, 2007.