TECHNICAL UNIVERSITY of CRETE

PROPERTIES OF ALKALI ACTIVATED MATERIALS PRODUCED FROM BRICK WASTE AND METALLURGICAL SLAG

A. Soultana, A. Valouma, A. I. Vavouraki, K. Komnitsas
Technical University of Crete
School of Mineral Resources Engineering

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AIM OF THE RESEARCH

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CONTENTS

CDW

METALLURGICAL SLAG

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The best way to manage CDW and slags is by recycling and safely transforming them into new products.

ALKALI ACTIVATED MATERIALS (AAMs)

CHARACTERIZATION OF RAW MATERIALS

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Particle size distribution of raw materials

	Bricks	Slag
d_{90} (µm)	94.3	45.6
d_{50} (µm)	16.7	8.9

CHARACTERIZATION OF RAW MATERIALS

Chemical analysis (%wt) of raw materials

	Bricks	Slag
SiO_2	59.06	32.74
CaO	17.75	3.73
Al_2O_3	10.15	8.32
MgO	1.90	2.76
K_2O	1.94	-
Fe_2O_3	7.36	43.83
Cr_2O_3	-	3.07
TiO_2	1.00	-
MnO	0.07	0.41
SO_3	0.45	0.18
Total	99.68	95.04

AAMs PRODUCTION

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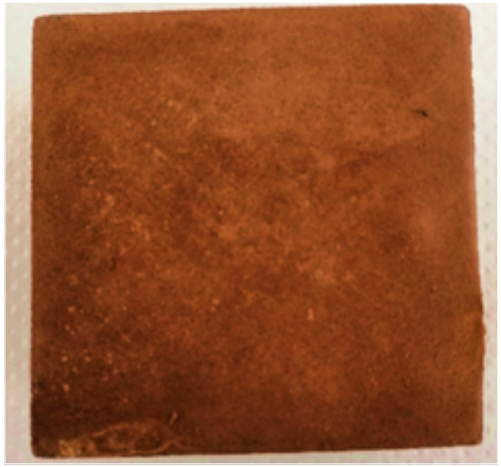
AAMs PRODUCTION



AAMs TESTING

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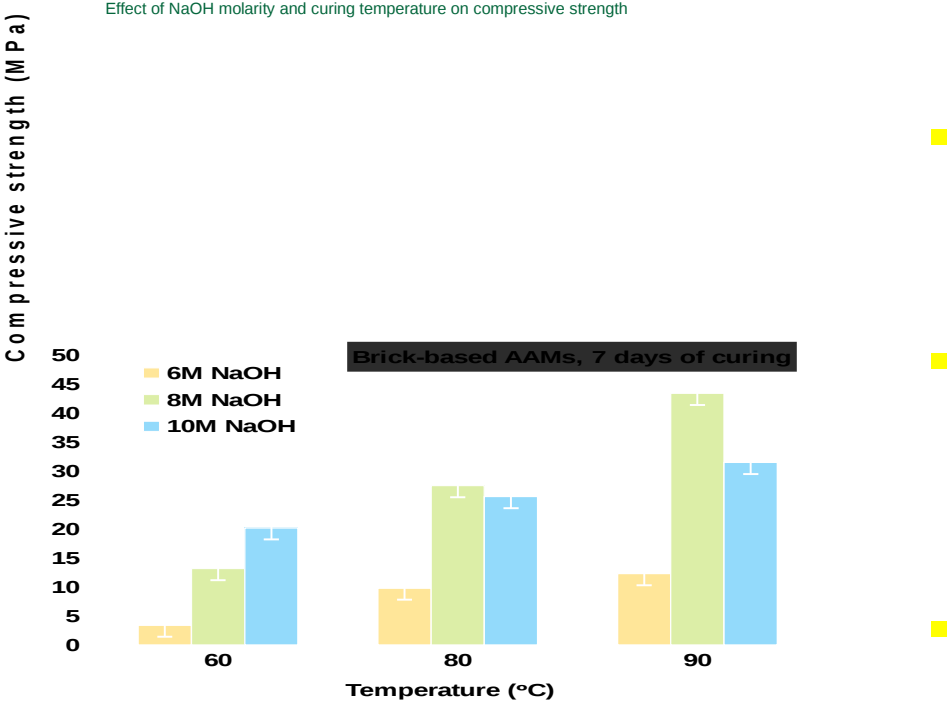
RESULTS

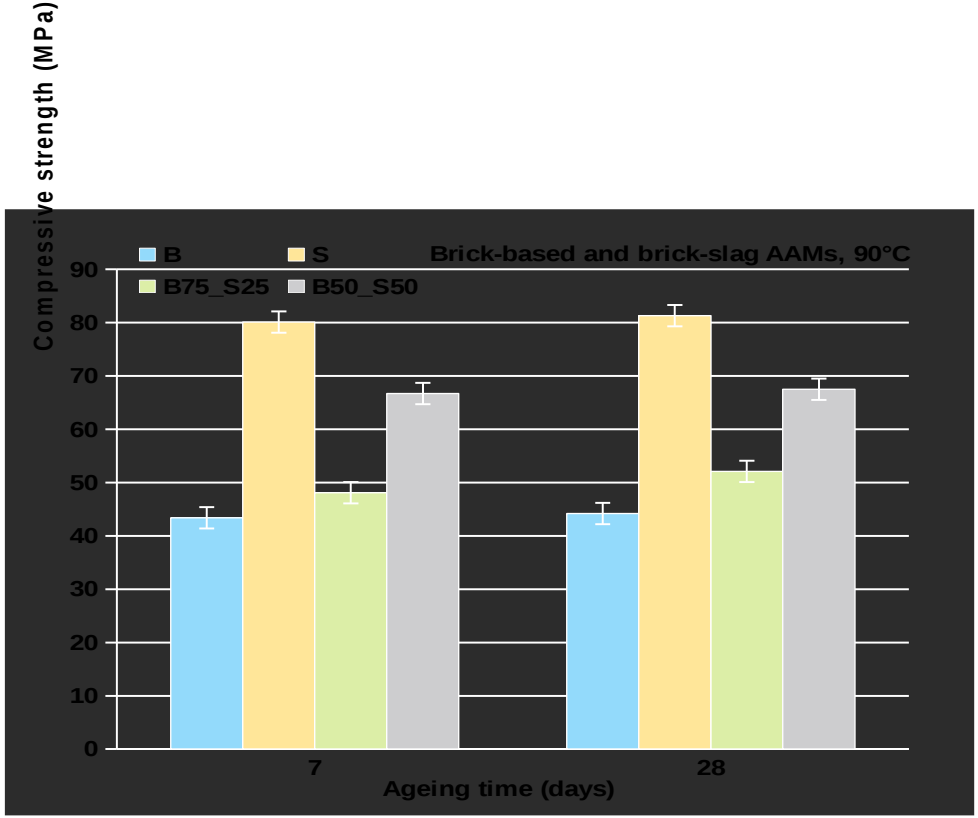
Effect of NaOH molarity and curing temperature on compressive strength



The highest compressive strength (43.4MPa) was obtained for the specimens synthesized with 8M NaOH, cured at 90°C.

RESULTS

Effect of ageing time on compressive strength



- Regarding brick-slag specimens, AAMs produced with 50%wt. brick replacement by slag (B50_S50) obtained the highest compressive strength (66.7 MPa).

RESULTS

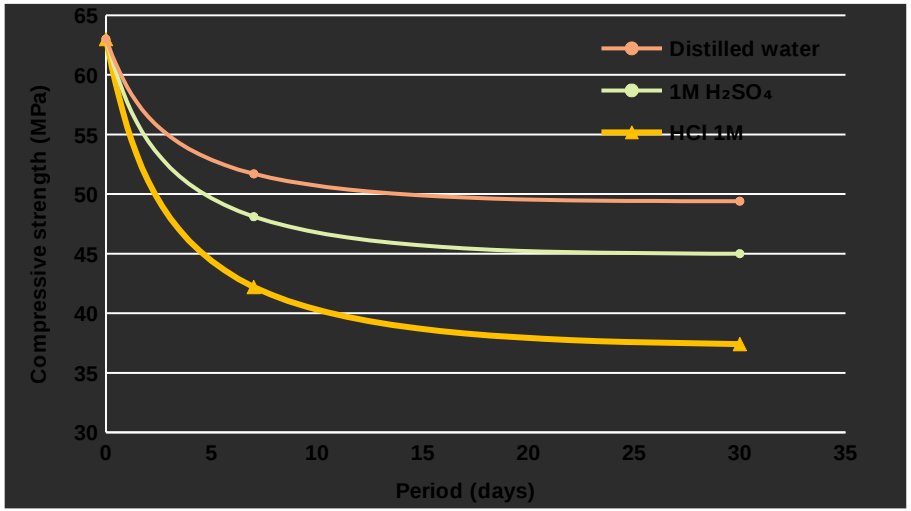
Physical properties of selected specimens

	Compressive Strength (MPa)	Water absorption (%)	Porosity (%)	Density (kg/m³)
B	**43.4**	**22.2**	**26.5**	**2020**
S	**80.1**	**4.21**	**10.87**	**2580**
B50_S50	**66.7**	**11.3**	**16.7**	**2100**

Slag addition decreased the porosity and water absorption and increased the density of the AAM specimens.

RESULTS

Structural integrity – durability performance of selected AAMs



- The greater compressive strength loss (40.6%) is seen for the AAMs immersed in 1M HCl for 30 days.

The reduction in strength is attributed to the disintegration of alumina-silicate bonds.
Despite the loss in strength the final values are considered high and show that the AAMs produced maintain their strength after long immersion in aggressive solutions.

RESULTS

Structural integrity – durability performance of selected AAMs

- AAMs immersed in HCl solution had the highest weight loss (3.5%).

RESULTS

Structural integrity – durability performance of selected AAMs

- good strength, varying between 37.4 MPa and 45 MPa
- mass loss less than 5%

CONCLUSIONS

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ACKNOWLEDGEMENTS

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Thank you!

Any questions?