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قسم

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Faculty of Science – Chemistry Department

Comprehensive Study on Alkali Activated Blast Furnace Slag – Metakaolin Based Geopolymer Cement

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Osama Fadel El-Kilany Ibrahim

List of Abbreviations

Abbreviation	Item
BFS	Blast furnace slag
MKa	Metakaolin of particle size 45, 125 µm
FMK	Fine metakaolin of particle size 45 µm
MK	Metakaolin of particle size 125 µm
XRD	X-ray diffraction
FTIR	Fourier transform infrared
SEM	Scanning electron microscopy
GPC	Geopolymer cement
PC	Portland cement
OPC	Ordinary Portland cement
SEM-EDS	Scanning Electron Microscopy-Energy Dispersive x-ray spectroscopy
TEM	Transmission electron microscopy
GGBFS	Ground granulated blast furnace slag
FA	Fly ash
POFA	Palm oil fuel ash
AAS	Alkali activated slag
AASP	Alkali activated slag paste
TGA	Thermo-gravimetric analysis
PDF	Pair distribution function
WG	Water glass
CSH	Calcium silicate hydrate
CASH	Calcium aluminum silicate hydrate
NASH	Sodium aluminum silicate hydrate

List of Abbreviations

NCASH	Sodium calcium aluminum silicate hydrate
PAM	Polyacrylamide
PEG	Polyethylene glycol
PAAS	Sodium polyacrylate
MIP	Mercury intrusion porosimetry
RAP	Recycled asphalt pavement
LSS	Liquid Sodium silicate
LSH	Liquid Sodium hydroxide
PAC	Poly aluminum chloride
UCS	Unconfined compressive strength
RCPT	Rapid chloride permeability test
ASR	Alkali silica reaction
GMs	Geopolymer mortars
MR	Molar ratio
PCM	Portland cement mortar
HPAASC	High performance alkali activated slag concrete
EAF slag	Electric Arc Furnace slag
QP	Quartz powder
AAMK	Alkali activated metakaolin
AAM	Alkali activated materials
FM	Foam Concrete
SCC	Self-compacting concrete
SF	Silica fume
PFA	Pulverized fuel ash
CBA	Combustion coal bottom ash
FBC	Fluidized bed combustion

List of Abbreviations

AAGU	Alkaline activated ground steel slag ultrafine palm oil fuel ash
AAB	Alkali activated binder
AFS	Alkali activated fly ash/slag
POC	Palm oil clinker
OPS	Oil palm shell
GM	Geopolymer mortar
WS	Wollastonite
TR	Tremolite
SBF	Short basalt fiber
CFBC	Circulating fluidized bed combustion
FESEM	Field emission scanning electron microscope

Comprehensive Study on Alkali Activated Blast Furnace Slag – Metakaolin Based Geopolymer Cement

Abstract:

The characterization of alkali activated cement prepared by blending blast furnace slag (BFS) and metakaolin (MKa) were studied. MKa of particle size 45, 125 μm and blain area 6530, 2245 cm^2/gm, respectively were used as 0, 20, 40, 60 and 80% replacement of BFS in the production of alkali activated cement. The utilized alkaline activator was mixture of NaOH and Na_2SiO_3 with various molar ratios. The prepared specimens were cured under two curing conditions; in 100% humid and air curing conditions up to 90 days. All specimens were characterized regarding setting times, compressive strength and water absorption. The formed hydrates were studied using XRD analysis, FTIR spectroscopy and SEM technique. The durability of the prepared geopolymer was determined via studying the fire resistance at 300, 600 and 800 ^oC and sulfate ions attack after time intervals extended up to 1 year. The results indicated that the specimens made from 60% BFS and 40% MKa and activated by (1:1) NaOH and Na_2SiO_3 were revealed the best overall behavior.

Key words: Geopolymer cement, Blast furnace slag, Metakaolin, Thermal resistance and Sulfate resistance.

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