



Cairo University

INFLUENCE OF THERMAL TREATMENT OF CEMENT KILN DUST ON THE REACTIVITY OF GEOPOLYMER SLAG BASED COMPOSITES

By

Rania Samy Saleh Abdel-Aziz Abdullah

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Structural Engineering

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Under the Supervision of

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Title of Thesis:

Influence of thermal treatment of cement kiln dust on the reactivity of geopolymer slag-based composites

Key Words:

Thermal treatment; CKD; Slag; Geopolymer Composites; Eco-Friendly

Summary:

In this research the influence of thermal treatment of cement kiln dust on the reactivity of geopolymer slag-based composites was studied. Three different sources of CKD were used. For each CKD source, two thermal treatment temperatures were investigated (700 & 800 °C). three different water to binder ratios 12%, 16% and 20% were investigated. Three curing regimes; ambient temperature, oven curing and microwave were tested and investigated. The compressive strength was measured and SEM and EDX techniques were carried out in order to interpret the results.

Disclaimer

I hereby declare that thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name:

Date:

Signature:

Dedication

*To my beloved husband, Tarek
Thank you for your love, kind support and help.
I really appreciate.*

*To my father's soul,
Who always supported me, whatever path I took,
I will always remember the things you have taught me and
how much you love me.*

*To my mother,
Who always encourage me to go on,
Thank you for your love and care.*

*To my beloved sons, Abdul-Rahman, Yassin and Aly
Your smile brightens up my world
I wish you all the best and happiness in life.*

*To all my family and friends,
without whom none of my success would be possible.*

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Nomenclature

Al_2O_3 , Aluminum Oxide

BFSC, blast furnace slag cement

CaO , Calcium Oxide

C-S-H, calcium silicate hydrate

$^{\circ}\text{C}$, Celsius scale

Cl, Chloride

CKD, Cement Kiln Dust

EDX, Energy Dispersive X-ray Analyses

Fe_2O_3 , Iron Oxide

GGBFS, Ground Granulated Blast Furnace Slag

GPC, Geopolymer concrete

K_2O , Potassium Oxide

Kg, Kilogram

Kg/cm^2 , Kilogram per square centimeter

LOI, Loss on ignition

MgO , Magnesium Oxide

MnO , Manganese Oxide

NaOH , Sodium Hydroxide

Na_2SiO_3 , Sodium Silicate

Na_2O , Sodium Oxide

NO_x , Nitrogen Oxide

OPC, Ordinary Portland Cement

P_2O_5 , Phosphorus pentoxide

PH, Scale of alkalinity

SEM, Scanning Electronic Microscope

SiO₂, Silicon Dioxide

SO₃, Sulfur Trioxide

SOX, Sulphur Oxides

TiO₂, Titanium Dioxide

XRF, X-Ray fluorescence