

# Author's Accepted Manuscript

## Characterisation and Properties of Geopolymer Composite Part 1: Role of Mullite Reinforcement

Suthee Wattanasiriwech, Faisal Arif Nurgesang,  
Darunee Wattanasiriwech, Patthamaporn Timakul



www.elsevier.com/locate/ceri

PII: S0272-8842(17)31377-9  
DOI: <http://dx.doi.org/10.1016/j.ceramint.2017.06.166>  
Reference: CER115688

To appear in: *Ceramics International*

Received date: 23 April 2017  
Revised date: 20 June 2017  
Accepted date: 26 June 2017

Cite this article as: Suthee Wattanasiriwech, Faisal Arif Nurgesang, Darunee Wattanasiriwech and Patthamaporn Timakul, Characterisation and Properties of Geopolymer Composite Part 1: Role of Mullite Reinforcement, *Ceramic International*, <http://dx.doi.org/10.1016/j.ceramint.2017.06.166>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and a review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain

# Characterisation and Properties of Geopolymer Composite Part 1: Role of Mullite Reinforcement

Suthee Wattanasiriwech<sup>a,b</sup>, Faisal Arif Nurgesang<sup>a</sup>, Darunee Wattanasiriwech<sup>a,b,\*</sup>, Patthamaporn Timakul<sup>c</sup>

<sup>a</sup>Materials for Energy and Environment (MEE) Research Group, Mae Fah Luang University, Thailand 57100

<sup>b</sup>School of Science, Mae Fah Luang University, Thailand 57100

<sup>c</sup>National Metal and Materials Technology Centre, Thailand 12120

\*Corresponding author. Tel: 6653916-263. darunee@mfu.ac.th

## Abstract

Geopolymer-mullite composite was prepared using fly ash and mullite powders with sodium silicate and sodium hydroxide as alkaline activators. Mullite was used as a replacement to fly ash in the 20-60 wt% range. Sodium silicate to sodium hydroxide (12M) ratio was 1:1 while the liquid to solid ratio was 0.6:1. X-ray diffraction (XRD) analysis revealed that the set of geopolymer specimens without mullite replacement (control) showed the co-existence of amorphous and crystalline phases of quartz, magnesioferrite ( $\text{Fe}_2\text{MgO}_4$ ), Lazurite ( $\text{Na}_{8.56}(\text{Al}_6\text{Si}_6\text{O}_{24})(\text{SO}_4)_{1.56}\text{S}_{0.44}$ ) and calcium silicate hydrate. With an increasing amount of mullite replacement, calcium silicate hydrate and magnesioferrite diminished while the new phase of phillipsite ( $(\text{K}, \text{Na})_2(\text{Si}, \text{Al})_8\text{O}_{16}\cdot 4\text{H}_2\text{O}$ ) emerged. Microstructural analysis revealed Si-rich mullite needles possibly occurred by recrystallization of the original mullite. This suggestion was also confirmed by the change of the crystallite size as analysed using an X-ray diffraction technique. The ambient compressive strength was found to increase from  $58\pm 21$  MPa for the control geopolymer to 72-76 MPa, with a much smaller uncertainty, for the geopolymer-mullite composite. Modulus of rupture (MOR) was found to improve significantly from  $0.7\pm 0.3$  MPa to  $3.7\pm 0.5$  MPa in the 20 % replacement and further to  $7.8\pm 1.3$  and  $8.1\pm 1.1$  MPa in the 40 and 60% replacement respectively. Improvement of fire resistance was observed in the 40-60% replacement thermal shock resistance property, however, was unchanged in these geopolymer-mullite composite.

Download English Version:

<https://daneshyari.com/en/article/5437228>

Download Persian Version:

<https://daneshyari.com/article/5437228>

[Daneshyari.com](https://daneshyari.com)