Preparation and Characterization of engineered stones based geopolymer composites

H.M. Khater, M. Ezzat

www.elsevier.com/locate/jobe

PII: S2352-7102(17)30383-2
DOI: https://doi.org/10.1016/j.jobe.2018.08.004
Reference: JOBE556

To appear in: *Journal of Building Engineering*

Received date: 13 July 2017
Revised date: 10 August 2018
Accepted date: 10 August 2018

Cite this article as: H.M. Khater and M. Ezzat, Preparation and Characterization of engineered stones based geopolymer composites, *Journal of Building Engineering,* https://doi.org/10.1016/j.jobe.2018.08.004

Effect of high pressure compaction on the characterization of alkaline hybrid composites

H.M.Khater[1], M. Ezzat[2]

[1]*Associated professor in Housing and Building National Research Centre (HBNRC)*

[2]*Researcher in Housing and Building National Research Centre (HBNRC)*

87 El-Tahreer St., Dokki, Giza, P.O. Box 12411Cairo

Tel: 00202-3761812-00201111686524

* E-mail: hkhater4@yahoo.com,

Abstract

The objective of the present paper is to study the effect of combination between the low liquid/solid (l/s) ratio and pressure compaction on the properties of the hardened engineered stone alkaline hybrid composites of water cooled slag/metakaolin using granite as filler and metakaolin using fine sand as filler in in the ratio of 1:3, while the used activator was 5% sodium hydroxide with liquid to solid ratio of 10% to ensure low water content for better organization of the binding materials upon pressure compaction. It is well known that these combinations increase the possibility of preparing engineered stones composites with excellent engineering properties. The results showed a high dense nano- or near-nano-pore structure with high degree of homogeneity and the high strength of alkaline hardened paste compacted with low l/s ratio.

The properties of the produced engineered stone alkaline hybrid composites have been studied through measurement of compressive strength, water absorption, bulk density, FTIR, petrographic examination and SEM-BSE imaging. The results exposed the possibility of forming a compact and dense composite on compacting with pressures ranging from 30 to 70 MPa.

Keywords: engineering stone; geopolymer; compact; composite.

1. Introduction

Alkali activated aluminosilicate are known with the ability to form alumino-silicate polymers – geopolymers, where the hardening mechanism involves chemical reaction of geopolymeric precursors, such as alumino-silicate oxides, with alkali polysilicates yielding polymeric Si–O–Al bonds. The production of geopolymeric precursors is carried out by calcinations of aluminosilicates such as natural clay materials and can be also from some industrial aluminosilicate waste materials. Various sources of silica (Si) and alumina (Al), generally in reactive glassy or fine grained phases, are added to concentrated alkaline solution for dissolution and subsequent polymerization to take place. Typical aluminosilicate precursors used are fly ash, ground blast furnace slags, and metakaolinite. Geopolymer or inorganic alumino-silicates polymer is synthesized predominantly from silicon and aluminum materials of a geological origin or from a by-product materials such as fly ash at ambient or higher temperatures **[Haradjito, et al. 2004)[a, b]]**. Geopolymers have excellent properties such as abundant raw resource, little