



10th International Conference Interdisciplinarity in Engineering, INTER-ENG 2016

Study on the Optimization of Some Lime Based Mixing Binders' Characteristics

Mircea Rujanu^a, Livia Ingrid Diaconu^{*,a}, Dănuț Traian Babor^a, Liviu Groll^a, Diana Plian^a

"Gheorghe Asachi" Technical University of Iași, Faculty of Civil Engineering and Building Services, Bd. Prof. dr. doc. Dimitrie Mangeron I, 700050 Iași, Romania

Abstract

The mixing binder based on lime represents the optimal solution for replacing of the silicate cements in the general effort of sustainable development. The construction lime is obtained at temperatures of about 1000^oC with a moderate energetical consume at construction lime's obtaining the carbon dioxide is released that will be neutralised in the chemical hardening process of the slacked lime. The silicate cements replacing with mixing binders based on construction lime presents interest by an inferior energetical consume beside the silicate clinkers and allows the recycling of a several industrial byproducts. The paper presents the results of the research from the Building materials discipline from Faculty of Civil Engineering and Building Services from Iassy, Romania on the using of the industrial byproducts in construction field. Were analyzed the characteristics of the construction lime - thermal power plant ash mixtures in the fresh mixture state and as well, for the final hardened state mixture.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of INTER-ENG 2016

Keywords: mixed binder; mortar; microconcrete, lime; fly ash.

1. Introduction

The exigencies of the sustainable development are including the silicate cements in the category of materials with an unfavorable impact on the environment [1,2]. Referring to the lime based on mixed binders, these are representing a favorable method for the silicate cement substitution, but in strictly conditions determined by the fact that during the setting and hardening process this binder has to be protected to humidity action.

* Corresponding author. Tel.: +40-723-706898.

E-mail address: liviagroll@yahoo.com

The utilization advantage of the lime based on mixed binders are answering to the exigencies of the energy consume and pollutants releasing for the manufacturing process and, in the same way, is favoring the including into some building materials composition of some industrial residuals, such as furnace slag and thermal power plant ash [2,3]. Introducing of such residuals in the materials composition from built structures represents a challenge for the society, because is resolving the depositing problem of the residual pollutant products, that represents a very complex issue and its settlement supposed great financial efforts [4].

The theory regarding the utilization of the mixed binders of type lime – slag, lime – trass, shows that these can be used to realize masonry elements, some foundations and other simple concrete elements, all of them presenting a low strength characteristic, and, in the same time, with the requirement that during the setting and hardening process, these elements to be protected against the humidity action. But, after the hardening, these products are presenting a good humidity behavior and of the water's direct action, so are presenting a hydraulic character [5].

From the practice point of view, in the conditions when is desired to introduce these binders in production, certainly, first of all the level of the mechanical strengths must be improved (unless the compression strength) and, finally the acceleration of the hydraulic character achievement by the acceleration of the admixture activation.

2. Experimental program

In this research, taking into account that diverse solutions regarding improvements at binders level, are analyzed, is proposed:

- The matrix where the binder will be introduced to be, by similitude with the polygranular quartz sand from the plastic mortars composition, a pit aggregate where the maxim dimension will be 4,00 mm (not 0,2 as this mortar and the sorted amounts will be:

0,00 – 0,50mm – 150g

0,50 – 1,00mm – 300g

1,00 – 2,00mm – 450g

2,00 – 4,00mm – 450g

- The binder's dosage will be 450g
- A/C ratio will be 0,50

The mixed binder is of type lime – ash having the following composition:

- Hydrated lime – 15%
- Thermal power plant ash collected by wet process – 85%

The utilized thermal power plant ash represents a hydraulic admixture. So, this will manifest a hydraulic character only in the activator's presence, in this case the hydrated lime, reacting with it resulting reaction products with hydraulic behaviour.

The weak strengths and the low hydraulic character represents the reason that for this research ultrafine silica was introduced in certain amounts, that as a well-known and studied reactive powder [5,6], can contribute to the mechanical strengths increasing, and in the same time has a favourable effect regarding the binder's hydraulic character's improvement.

Also was introduced a second testing method aiming to improve the binder's mechanical characteristics, by the utilization in the main receipt of a superplasticizer additive, that by the mixing water's reducing and the favourable modification of the reaction products structural morphology, leading to significant strength increasing [7,8].

Regarding to the aggregate granule's maxim dimension increasing, this is equilibrating the entire specific surface of the aggregate and of the mixed binder with the specific surface of the polygranular quartz aggregate and of the cement from the plastic mortars, is known that the thermal power plant ash has a greater specific surface than the cement and, by compensation, the aggregate for the mixtures with mixed binder must have a lower specific surface.

Download English Version:

<https://daneshyari.com/en/article/5028817>

Download Persian Version:

<https://daneshyari.com/article/5028817>

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