

Thermal activation and mechanical properties of kaolinite /quartz mixtures

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Abstract : Kaolinite is used to obtain artificial pozzolans from its calcination products. Unfortunately, it does not occur in natural conditions as a pure phase but always mixed in various proportions with many secondary minerals. Among them, quartz is one of the most common associated minerals.

Natural clays, mainly composed of kaolinite and quartz, have been burnt at 600, 700 and 800°C and the calcination products have been characterized by XRD supplemented by SEM observations and granulometric analysis, in order to determine the quartz influence on kaolinite calcination. Mechanical strength tests on portlandite/calcination products pastes have been performed and compared to those obtained on pastes prepared from quartz added to burnt kaolinite. Results allow to ascertain the role of quartz as a function of the burning temperature, the burning time, the water/solid ratio on the development of mechanical strength.

Introduction

It is well recognized that blending pozzolanic material with Ordinary Portland Cement (OPC) results in enhanced performance of mortars and concretes. The enhanced performance includes, for instance, level of long term strength, lower permeability, reduced diffusion coefficients, increased sulfate resistance. Many of these features are closely linked to the refinement of the pore structure by the pozzolanic materials [1, 2].

Thermal activation of natural clays is one of the most interesting choice to obtain pozzolans and the properties of such products has received extensive attention [3, 4, and 5]. Among clay deposits, kaolinitic clays are considered in the literature as the most adequate raw material for production of pozzolans by thermal activation.

However, it must be pointed out that the development of pozzolanic properties from kaolin will depend strongly on the deposit that can be highly variable in amount of kaolin, in mineralogy and chemical composition and also the calcination conditions (time and temperature) [3, 5].

Therefore, an investigation has been carried out to assess quantitatively the effect of mineralogical variability of natural clay deposits, mainly composed of kaolin and quartz, on the rheology and the development of compressive strength of pastes composed of calcined products and portlandite taking into account various burning conditions. When appropriate, mixture of pure kaolinite and quartz have been selected for comparison purpose and for highlighting the possible influence of quartz content on compressive strength results as a function of calcination conditions.