Accepted Manuscript

Assessment of pore structure evolution in the limestone calcined clay cementitious system and its implications for performance

Yuvaraj Dhandapani, Manu Santhanam

PII: S0958-9465(16)30558-3

DOI: 10.1016/j.cemconcomp.2017.08.012

Reference: CECO 2891

To appear in: *Cement and Concrete Composites*

Received Date: 18 September 2016

Revised Date: 31 July 2017

Accepted Date: 21 August 2017

Please cite this article as: Y. Dhandapani, M. Santhanam, Assessment of pore structure evolution in the limestone calcined clay cementitious system and its implications for performance, *Cement and Concrete Composites* (2017), doi: 10.1016/j.cemconcomp.2017.08.012.

Assessment of pore structure evolution in the limestone calcined clay cementitious system and its implications for performance

Yuvaraj Dhandapani and Manu Santhanam*

Department of Civil Engineering, IIT- Madras, Chennai 600036, India

*Corresponding author. E-mail address: manusanthanam@gmail.com (M. Santhanam)

Abstract

Use of limestone and calcined clay together for clinker substitution makes an effective low clinker cement blend, which shows promising mechanical properties at early ages. The performance of these cementitious systems strongly depends on the pore structure, which is a dominant factor governing the durability characteristics because of its direct influence on the transport properties. The experimental study described in this paper on three different binder systems including Ordinary Portland Cement, Portland Pozzolana Cement - with 30% Type F Fly Ash (designated FA30) - and Limestone Calcined Clay Cement (LC^3) pastes shows that the LC^3 system attains greater refinement of the pore structure as early as 3 days, as seen from mercury intrusion porosimetry. Electrical measurements also reveal lower conductivity in the system, which suggests better resistance to ionic transport in the binder phase. The results of hydrate phase assemblage studied by X-ray diffraction also indicate that greater amount of hydrates contribute in a major way to the reduction in the (water-filled) porosity in all the systems. This change occurs at varying rates for the different systems due to the difference in hydration characteristics. The estimated permeability suggests that the LC^3 binder system attains much lower permeability compared to the ordinary Portland cement and FA30. A comparison of the formation factor shows distinct differences in the microstructural development and suggests a more durable binder with LC^3 cementitious system.

Keywords

Limestone; calcined clay; pore structure; conductivity; formation factor