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Article / Book Information

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Thesis Outline

This thesis describes the development of fly ash (FA) blended cement with high alite (tricalcium silicate, Ca_3SiO_5, commonly referred to as C_3S) clinker. The structure of this thesis comprises an introduction, a simulation of the hydration of FA blended cement, followed by a description of the synthesis of high C_3S cement, an investigation of the effect of high C_3S clinker in FA blended cement, and the associated microstructure of such cement, and, finally, conclusions are drawn. Blended cement is one of the alternative ways to reduce CO_2 emissions, but blended cements still have low early-stage strength compared with Ordinary Portland Cement (OPC). This work proposes a new type of FA-blended cement for improved mechanical properties and reaction ratio at an early stage by using high alite clinker.

Chapter 1 Introduction and Objective

Basic knowledge related to this research will be presented in this chapter. Along with a survey of previous studies that had been done these past decades. Considering the advantages and disadvantages of blended cement, the purpose of this study has been proposed.

Chapter 2 Simulation for Hydration of Fly Ash Blended Cement

A new model modified from Tomozawa's hydration model of cement will be proposed in this chapter. The importance of simulation model for materials design has been demonstrate by results of simulations. Data from this chapter was used to plan the target cement composition.

Chapter 3 Synthesis of High C_3S Cement

Synthesis procedure for new type of cement will be explained in this chapter. Important factor of cement production will be described and the reason of clinkers selection will be discussed. The final results from this section indicated that high alite cement has alite content limitation in actual process. However, the production of this kind of cement is possible.

Chapter 4 Effect of High C_3S Clinker in Fly Ash Blended Cement

This chapter contain necessary studies and experiment for understanding hydration mechanism of high alite cement together with replacement materials. Heat of hydration, hydrated product, reaction ratio of alite, fly ash and C-S-H structure analysis were done in this section. Theoretical consideration of hydration mechanism by new proposed model from chapter 2 will also be discussed.

Chapter 5 Microstructure of Blended High C_3S Cement

In order to compare strength properties of samples, a series of analysis and studies of microstructure were done in this chapter. Relationship between porosity, compressive strength and gel-space ratio will be discussed. New simulation model was used in this section to simulate gel-space ratio of high alite cement compared with OPC.

Chapter 6 Conclusion

Results and discussion of this research are summarized in this chapter