Hydration study of alite-ye'elimite-anhydrite phases associated to BAY cement

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Abstract

An alternative to decrease CO_2 emissions from OPC production consists on the development of a new kind of eco-cements composed by less calcite demanding phases, such as belite and ye'elimite. That is the case of Belite-Ye'elimite-Ferrite (BYF) cements. Since the reactivity of belite goes slowly, these materials develop low mechanical strengths at intermediate hydration ages. A possible solution to solve this problem consists on the production of cements which contain belite, alite and ye'elimite together, known as Belite-Alite-Ye'elimite (BAY) cements. Consequently, the reaction of alite and ye'elimite with water would develop cements with high mechanical strengths at early ages, while belite will contribute to later ages.

The main objective of this work is to understand the hydration reactions of pure ye'elemite (both stoichiometric and pseudo-cubic polymorphs) with pure monoclinic alite (C_3S) and with anhydrite, in order to be compared with a BAY eco-cement real system. The effect of the water/cement (w/c) ratio was studied on the hydration kinetic of alite-ye'elimite pastes. BAY pastes will be also analyzed and compared to understand the dissolution/crystallization processes that take place in both cases. The techniques used for this study were in-situ and ex-situ Synchrotron/Laboratory X-ray powder diffraction combined with Rietveld methodology, thermogravimetric and isothermal calorimetric analyses.

***Keywords**: BAY cement, alite/ye'elimite/anhydrite phases, Synchrotron/Laboratory X-ray powder diffraction, Rietveld Quantitative Phase Analysis.*

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