'IN-SITU HYDRATION STUDIES OF YE'ELEMITE AT EARLY AGES FOR UNDERSTANDING ECO-CEMENT PERFORMANCES'

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CSA cements may have variable compositions, but all of them contain ye'elimite, also called Klein's salt or tetracalcium trialuminate sulfate ($Ca_4Al_6O_{12}SO_4$). Commercial cements with large amounts of ye'elimite have special applications such as high strength developments at early-ages. This phase is also included, ~25 wt%, in sulfobelite cements [3].

Yeelimite, $Ca_4Al_6O_{12}SO_4$, is very reactive and most of the hydration heat it released during the first eight hours. Here, we propose to study the hydration reaction(s) of ye'elimite at early ages (the first 48 hours) to understand eco-cement performances. Stoichiometric ye'elimite presents an orthorhombic sodalite type structure [2] [a=13.0356(7) Å, a=13.0350(7) Å and c=9.1677(2) Å] while Fe-doped ye'elimite crystallizes in a pseudo-cubic unit cell [a=9.2047(2) Å].

The aim of the proposed work is to study the hydration behavior of yeelemite, both stoichiometric and Fe-doped polymorphs, at early ages in order to understand "eco-cement" performances. Chiefly, we want to determine the hydration kinetic of the ye'elimite phase with different water/cement ratio and with different calcium sulfate sources such as gypsum and anhydrite and also without any of them .All the samples has been mixed with 15 wt% of quartz as internal standard. Figure 1 shows a Rietveld Synchrotron X-Ray Powder Diffraction plot for stoichiometric ye'elimite and gypsum at 3 h of hydration with w/c=1.42. It can be observed that a big amount of ettringite has already crystallized. The results of RQPA has been 20.8 wt% of ye'elimite, 5.9 wt% of gypsum, 13.6 wt% of quartz and 59.7 wt% of ettringite.

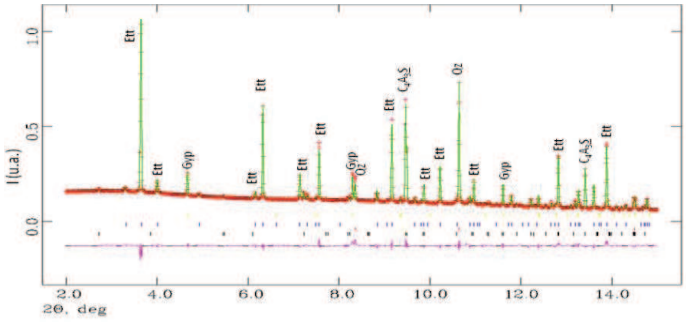

Figure 1. Rietveld Synchrotron X-Ray Powder Diffraction plot for stoichiometric yeelimite and gypsum at 3 h of hydration with w/c=1.42 (Ett: ettringire; Gyp: gypsum; Qz: quartz; $C_4A_3\underline{S}$: ye'elimite)

The final goal is to study the hydration in the early ages in order to understand the dissolution/crystallization processes that take place. The different samples have been studied at different ages of hydration in order to understand the progress of the hydration. Figure 2 shows the evolution with the time for a hydrated sample that illustrates how the hydrated phase AFm-type is consumed and ettringite is being formed.

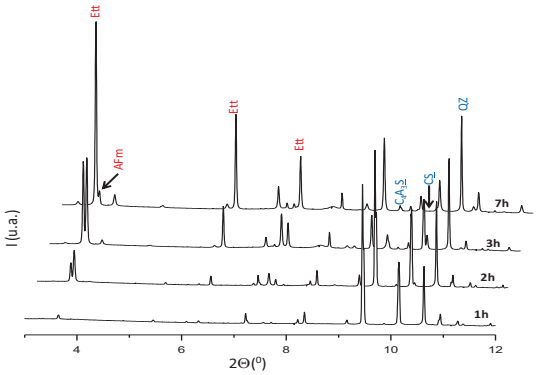

Figure 2. Raw synchrotron XRPD pattern evolution with the time for the mixye'elimite and anhydrite with a w/c=1.64. (Ett: ettringite; $C\underline{S}$: anhydrite; Qz: quartz; $C_4A_3\underline{S}$: ye'elimite)

REFERENCES

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