World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:15, No:10, 2021

# Effect of Iron Oxide Addition on the Solid-State Synthesis of Ye'Elimite

**Authors :** F. Z. Abir, M. Mesnaoui, Y. Abouliatim, L. Nibou, Y. El Hafiane, A. Smith

**Abstract :** The cement industry has been taking significant steps for years to reduce its carbon footprint by opting for an eco-friendly alternative such as Calcium Sulfoaluminate Cements (CSA). These binders, compared to Ordinary Portland Cements (OPC), have two advantages: reduction of the CO2 emissions and energy-saving because the sintering temperature of CSA cements is between 1250 and 1350 °C, which means 100 to 200 °C less than OPC. The aim of this work is to study the impurities effect, such as iron oxide, on the formation of the ye'elimite phase, which represents the main phase of Calcium Sulfoaluminate Cements and the consequence on its hydration. Several elaborations and characterization techniques were used to study the structure and microstructure of ye'elimite, such as X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), thermal analysis, specific surface area measurement, and electrical conductivity of diluted solutions. This study details the protocol for the solid-state synthesis of ye'elimite containing increasing amounts of iron (general formula: Ca4Al(6-2x)Fe2xSO16 with x = 0.00 to 1.13). Ye'elimite is formed by solid-state reactions between Al2O3, CaO and CaSO4 and the maximum ye'elimite content is reached at a sintering temperature of 1300 °C. The presence of iron promotes the formation of cubic ye'elimite at the expense of the orthorhombic phase. The total incorporation of iron in ye'elimite structure is possible when x < 0.12. Beyond this content, the ferritic phase (CaO)2(Al2O3,Fe2O3) appears as a minor phase and develops two different morphologies during cooling: dendritic crystals and melt morphology. The formation of the ferrous liquid phase affects the evolution of grain size of the ye'elimite and calcium aluminates.

**Keywords :** calcium sulfoaluminate cement, ferritic phase, sintering, solid-state synthesis, ye'elimite
**Conference Title :** ICCCC 2021 : International Conference on Cement and Concrete Chemistry
**Conference Location :** Istanbul, Türkiye
**Conference Dates :** October 25-26, 2021