The Influence of Calcination Conditions on the Reactivity of Natural Hydraulic Limes Produced from a Neogene Limestone from Crete ,Greece.

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Natural hydraulic limes (NHL) are produced by burning of a natural occurring raw material, such are argillaceous or siliceous limestones, which are fired and then are slaked by the addition of controlled amounts of water (slaking), reduced to a powder with or without further grinding. Burning takes place in vertical kilns at temperatures lower than 1250^{o}C, i.e. lower than the temperature used in the manufacture of cement clinker.
During firing silica combines with CaO to form calcium silicates (CS) which induce hydraulic properties to the products. NHL contain mainly calcium hydroxide $Ca(OH)_2$and dicalcium silicate (Ca_2SiO_4), (Markopoulos, Th. et al., 2004). Optimization of the calcination conditions is aimed in order to obtain a product with a high ratio of hydraulic components and a highly reactive content of free lime (CaO) as well.
The raw material used in this study is a Neogene fossiliferous marly limestone, cropping out 30 km east of Chania, Crete. The samples have been analyzed mineralogically and chemically. The main minerals present are calcite and quartz, whereas clays, micas, dolomite and feldspars are present in minor amounts. The ratio $CaO/SiO_2$is sufficient for the Ca_2SiO_4formation(Miras et al 2007). A series of calcination experiments was undertaken in the range 850- 950^{o}C for 9 and 12 hours. The reactivity of the produced CaO was determined according to the slaking rate test (EN 459-2). This test evaluates the temperature rise which occurs on reaction with water as a function of the reaction time. The different mineralogical phases present in the, calcined, products were identified and quantified using X-ray diffraction analysis.
The products retain a high percentage of calcium hydroxide, above 45%, in all calcination conditions. The intensity of calcination affected considerably the reactivity of the produced calcium oxide. Calcination at low temperatures produces more reactive free lime, which converted rapidly to calcium hydroxide during laboratory processing and storage of the cements. Furthermore, the duration of the calcination seems to be very important, since after 12 hours of burning the raw materials, the amount of dicalcium silicate increases. This in turn improves the hydraulic behaviour of the product, but, on the other hand decreases the reactivity of the calcium oxide produced.

References

EN 459-2. , Building lime, Part 2.Test methods (2001)
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