**CALCINED CLAYS FOR LOW-CO2 CEMENT & CONCRETE PRODUCTS**

**D. Papargyriou\*, V. Michalis, E. Tzanis, K. Issari, D. Michelis, O. Tsichla, I. Baskoutas, M.S. Katsiotis­, D. Papageorgiou**

TITAN Cement S.A., Athens, Greece

*\** [d.papargyriou@titan.gr](mailto:d.papargyriou@titan.gr)

**ABSTRACT**

The European cement industry is continuously taking actions and initiatives to improve the CO2 footprint of operations and products, embracing the vision of the European Green Deal to achieve climate neutrality by 2050. TITAN Cement Group has adopted a strategy to mitigate its CO2 emissions across the supply chain, receiving recognition by CDP (Carbon Disclosure Project) as a global climate leader for its transparency and actions to mitigate climate change and transition to a net zero economy. [1]

Among ways to lower CO2 emissions associated with cement production, the use of supplementary cementitious materials (SCM’s) is a sustainable option to provide products with improved carbon footprint. Since certain SCM’s, originating as byproducts of other heavy industries, are expected to become less available in locations where decarbonization of industrial and power production processes is under way, the need to develop new streams of sustainable, low-CO2 SCM’s is emerging. [2]

Thermally activated clays (Calcined Clays) originate from raw materials available in many locations globally and exhibit strong potential for use in cement and concrete. Depending on their chemical and mineralogical composition, clays can be thermally activated between 600-900 °C. Furthermore, calcined clays in combination with limestone, have a synergetic effect that further enhances their performance in cement and concrete. [3]

In this study, the potential to use clays of varying mineralogy as SCM’s has been investigated, towards production of low-carbon cement and concrete. Mineralogical and chemical composition determined by Powder X-Ray Diffraction (XRD) and X-Ray Fluorescence (XRF), provide initial indication of potential reactivity; clay activation profile has been determined by thermogravimetric analysis (TGA) and Differential Scanning Calorimetry (DSC). Calcination conditions were investigated at lab scale and the optimum calcination temperature was determined per case.

Clays with significant kaolinite content exibited superior reactivity, allowing to improve carbon footprint by at least 30%, compared to CEM I cements. Other types of clays demonstrated satisfactory reactivity, exhiting performance at par with CEM II cements. Calcined clays demonstrated equivalent performance to conventional SCM’s in concrete testing as well, with promising results on durability.

**KEYWORDS:** cement industry, calcined clays, kaolinite, illite

**REFERENCES**

[1] "TITAN Cement Group awarded Leadership Status on climate change by CDP," TITAN Cement Group, 14 December 2021. [Online]. Available: https://www.titan.gr/en/newsroom/news-and-press-releases/new?item=1597.

[2] Scrivener, K., Martirena, F., Bishnoi, S., Maity, S., (2018). *Cement and Concrete Research.* 114 (1): 49-56.

[3] Scrivener, K., Avet, F., Maraghechi, H., *et al*. (2019). *Green Materials* 7(1): 3–14.