

VitroGeoWaste III

Implementation of the Circular Economy principles through the valorization of bauxite residue from aluminum production in the manufacture of low energy cements

Oral presentation / Poster presentation

Sergio Martínez-Martínez

Department of Chemical, Environmental and Materials Engineering, University of Jaén, Spain

smartine@ujaen.es

Luis Pérez-Villarejo

Department of Chemical, Environmental and Materials Engineering, University of Jaén, Spain

Abstract: Aluminum is the most common metal present in the Earth's crust. Bauxite, a combination of hydrated aluminum oxides and other minerals, is the primary aluminum ore. Global production of aluminum is approximately 69 million tons, with China being the main producer (40 million tons). One of the big problems for the environment generated by the production of aluminum is the production of red mud waste (RM), of which approximately 120 million tons are produced per year. Due to this, it is necessary to find ways to value this waste under the principles of the circular economy. In this study, the valorisation of red mud as raw material in 5 wt.% and 10 wt.% in the production of low energy cement clinkers was investigated. Four types of clinkers were prepared and designed using Bogue equations. In the first two clinkers, alite (C3S) content was 20.6 wt.% and 13.9 wt.% and the content of belite (C2S) was comparable, 55.5 wt.% and 55.8 wt.%. The other two clinkers were designed with zero C3S content and the C2S varied, 74.9 wt.% and 69.3 wt.%. The firing was performed at 1330 °C. Fast cooling by blown air and concurrent crushing was applied for arresting the β - polymorphic form of C2S. The results demonstrate that the microstructure of the produced clinkers is dominated by belite crystals with tricalcium aluminate and tetracalcium-alumino-ferrite present as micro-crystalline interstitial phases. The prepared cements present slow early strength development as expected for belite-rich compositions.