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Abstract

Alkali Activated Cements Based on Slags from Different Industries †

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In recent decades, much research on new materials for civil engineering has emerged. The aim of those research studies is to replace Portland cement due to its high environmental cost. Materials with high performance for that matter are alkali-activated materials [1]. These new types of binder material have obtained good results in terms of mechanical strength and durability [2], but their properties depend on raw materials used and their provenance.

In this study, a comparison was made between the uses of different slags as raw materials: black steel slag, ladle furnace slag, copper slag, and ferrosilicon slag. One-hundred percent of slag was used as a precursor, and the activator was a mixer with different proportions of KOH (8M) and K_2SiO_3: 35–65, 50–50, 65–35, and 75–25 (% KOH-% K_2SiO_3). The precursor and activator were mixed in a mixer, and they were poured into prismatic (10 × 10 × 60 mm) and cylindrical (diameter 25mm) molds. After one day, pastes were demolded, and they were cured in climatic chamber for 7, 28, and 90 days for testing. In addition, at 28 days of curing, pastes were attacked by different solutions in order to verify the durability of pastes.

Pastes manufactured were characterized after and before attack by mechanical strength, thermal conductivity, ATR-FTIR (Vertex 70 Bruker, Billerica, MA, USA), XRD (Empyrean equipment with PANalytical PIXcel-3D detector, Malvern, UK), and SEM-EDS (JEAL model SM 840, Peabody, MA, USA).

The optimal activator was different for each precursor, highlighting copper slags such as the precursor. The same behavior was verified with durability tests by comparing the percentage losses of properties.

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