

VitroGeoWaste III

Alternative activators in alkali activated cement based on electric arc furnace slag

Oral presentation / Poster presentation

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Abstract: In recent decades, construction materials have been subject to extensive research, primarily because their manufacturing processes result in significant greenhouse gas emissions. Current research efforts seek to reduce these emissions while also minimizing the amount of materials deposited in landfills. This has led to the development of alkali-activated materials. These materials require a precursor, a source of aluminosilicates, and a basic activator. The precursors used in the production of alkali-activated materials can either be of natural origin or derived from various waste and by-products sources. The latter have been extensively studied in recent decades, driven by waste reduction policies.

In this study, electric arc furnace slag, extensively documented in the literature, have been employed. These slags have been activated using various commercially available solutions, including hydroxides, silicates, or a combination of both. This study introduces novel methods for activating electric arc furnace slag. To achieve this, fly ashes from olive pomace were utilized to create the optimal basic environment for dissolving the reactive species within the slag. As a source of silicon, rice husk ash, glass waste, and diatoms were employed. Furthermore, two curing temperatures, 20°C and 80°C, were employed for 24 hours to enhance the dissolution of reactive species. As control samples, specimens were manufactured using 100 wt. % of slag with an activator of potassium hydroxide at concentrations of 5M, 8M, and 12M. The synthesized samples were tested for mechanical strength (flexural and compressive) at 1, 7, 28, and 90 days. Additionally, physical properties such as apparent density, apparent porosity, and water absorption, as well as thermal conductivity, were analysed. Furthermore, the most promising samples underwent characterization through FTIR, XRD, and SEM-EDX analyses.

The results indicate that alternative activators to commercial solutions can yield materials with superior mechanical, physical, and thermal properties. Consequently, the samples were produced exclusively using waste and industrial by-products. By utilizing a combination of olive pomace fly ashes and glass waste in the activator,

the study achieved the most promising outcomes. While these materials may not reach high mechanical strengths, they could find application as non-structural materials in construction engineering.

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