Current Topics and Trends on Durability of Building Materials and Components

Carles Serrat, Joan Ramon Casas and Vicente Gibert (Eds.)

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Slags in Cement-based Materials

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Soft Computing Tools and Sustainable Building Construction and Maintenance

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Durability Studies on Fiber-Reinforced Siderurgic Concrete

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Abstract: The construction sector is clearly one of the most pollutant *at a global level and its consumption of natural resources is also enormous. Over recent years, heightened awareness of this issue within the construction sector has motivated changes within its working practice, seeking to reduce its environmental impacts and to mitigate the effects of climate change. The consumption of natural resources can be reduced in very different areas and special attention has been given to the substitution of Natural Aggregates (NA) in concrete design by replacing those aggregates with various waste co-products. Siderurgic concrete is the name given to concrete manufactured with siderurgical aggregate from the steel-making industry. In this paper, test results on fiber-reinforced siderurgical concrete are reported. The concrete is manufactured with approximately 50% Electric Arc Furnace Slag (EAFS) aggregate by volume, for use in pavement applications. Steel and polypropylene fibers, amounting to approximately 0.5% by volume of the concrete mass, are also added to the mix. The durability properties of this concrete type are analyzed through freeze/thaw and moist/dry tests. Furthermore, the long-term behavior of the concrete is explained through its internal structure, using Mercury Intrusion Porosity (MIP) and low-vacuum Scanning Electron Microscopy (SEM) analyses. The results add further weight to the feasibility of using EAFS in replacement of NA in fiber-reinforced concrete for pavement construction.*

Keywords: *EAFS, Freeze/Thaw, Moist/Dry, MIP, SEM.*

1 Introduction

The immense volumes of natural aggregates used for concrete production within the construction sector has motivated a search for feasible alternatives to natural resources. In consequence, several studies have over the past few decades examined the incorporation of slag from the steelmaking industry in construction and civil engineering applications (Akinmusuru, 1991; Faleschini *et al.*, 2015; Geiseler, 1996; Koros, 2003; Manso *et al.*, 2006; Motz and Geiseler, 2001; Pellegrino and Gaddo, 2009; Qasrawi, 2014; Santamaría *et al.*, 2017).

Although productive steel processes differ between plants, they may at present be divided into two types: Integral Siderurgy, in which the raw material, iron ore, is melted in a Blast Furnace, followed by a decarburization phase, usually in an Oxygen-Blow Converter, and the

4 Conclusions

The conclusions of this work can be summarized as follows:

- The fiber-reinforced siderurgic concrete mixtures showed good mechanical properties. The results of the concretes reinforced with steel fibers were in general better than those for the concretes reinforced with polypropylene fibers.
- Durability tests delivered good results for the fiber-reinforced siderurgic concretes, yielding smaller variations of weight and strength after several conditions.
- MIP and SEM analyses revealed the good internal cohesiveness of both aggregates and fibers within the cement matrix, which favored their durability.

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