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SUSTAINABLE MASONRY MORTARS BASED ON LADLE FURNACE SLAGS FROM THE STEEL-MAKING INDUSTRY

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ABSTRACT

Masonry mortars are applied to concrete and brickwork to form structural bonds. Partial substitution of their natural raw materials by waste products from the steel industry represents a sustainable approach towards the ecological management of those materials in Spain, where iron and steelmaking is a highly developed heavy industrial sector. Additionally, a somewhat more traditional industrial sector, the building industry, also consumes large amounts of natural resources and energy, likewise resulting in high CO_2 emission levels. The present research is focused on solid waste from the steelmaking industry and its addition in significant amounts to masonry mortars. Labelled as “white” slag, the waste (saturated in alumina) is commonly known as ladle furnace slag. To do so, several lab tests are presented, which investigate the partial substitution of fillers and hydraulic binders in regular masonry mortars. Firstly, the study of ladle furnace slag and its overall properties and, secondly, studying the feasibility of producing Ladle Furnace Slag mortars, yielded interesting and positive results.

KEYWORDS: Cement; partial substitution; high in alumina; active addition; aggregate.

1. INTRODUCTION

Masonry mortars are useful solutions for the rehabilitation of both old and new structures made of concrete and brickwork. The partial substitution of their natural raw materials by waste products from the steel industry is a sustainable approach towards those materials in Spain where iron and steel-making is a highly developed heavy industrial sector [1].

The replacement of Portland cement by an LFS co-product appears to be a promising application; nevertheless further investigations will be needed. In conclusion, the use of LFS in masonry mortars for various uses is a feasible option: layering for façades, rendering/plastering for partitioning, and for brickwork. The re-use of LFS in that way will therefore make a positive contribution to global sustainability by reducing greenhouse gas emissions, in proportion to the levels of cement substitution (1 t-CEM over 0.7 t-CO_2).

Apart from these positive conclusions, it should be stressed that some additional aspects need to be studied in a near future, such as, for example: water absorption, adhesion to bricks or stones, etc.

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