ALTERNATIVE BINDER TO PORTLANDCEMENT PRODUCED WITH MAGNESIUMOXIDE AND METAKAOLIN

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1. INTRODUCTION

The construction sector is constantly growing, similar to the production and consumption of Portland cement. However, its entire production and use process requires a large consumption of natural resources and high energy consumption, in addition to being one of the main sources of emissions of so-called greenhouse gases (SCRIVENER, 2014; CAO et al. 2021; WALLING e PROVIS, 2016; ALI et al., 2011; RASHAD e ZEEDAN, 2011).

In this way, alternative formulations for the binder have been studied; among them, magnesium cement stands out, which, among different formulations, can be produced by combining magnesium oxide (MgO) and a siliceous material, that is, rich in silicon dioxide. (SiO2 – also called silica), resulting in a binder with characteristics similar to Portland cement and which presents several sustainable aspects.

In view of the above, this work aimed to study the behavior of an alternative binder composed of MgO and metakaolin as a source of SiO2 for the system and compare it to a more studied reference system composed of MgO and silica fume (the most commonly used source of SiO2). For this purpose, pastes were prepared and analyzed with two different proportions of constituents (40/60 and 60/40 by mass) and with two different water/binder (w/a) ratios (0.6 and 0.7). Figure 1 presents examples of test specimens used in the research.

Figure 1: Examples of specimens used.
Source: Authors.

2. METHODOLOGY

The experimental program included x-ray fluorescence (XRF) assays, x-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM); thermogravimetry (TG), compressive strength; temperature by time and water absorption by capillarity.

3. RESULTS

The results obtained allowed us to understand that the combination of MgO with metakaolin produces hydration products capable of providing compression resistance to the pastes, as occurs with the MgO and silica fume system, and also that, due to the presence of alumina in the chemical composition of metakaolin, the formation of another hydration product, called hydrotalcite, was confirmed. The compressive strength achieved with metakaolin pastes was lower than that of the reference system with silica fume, and therefore future studies should be conducted to improve the system.

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