

Article

Combined Effects of Non-Conforming Fly Ash and Recycled Masonry Aggregates on Mortar Properties

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Abstract: This work evaluates the effects of using non-conforming fly ash (Nc-FA) generated in a thermoelectric power plant as filler material for mortars made with natural sand (NA) and recycled sand from masonry waste (FRMA). The incorporation of powdered recycled masonry filler (R-MF) is also tested as an alternative to siliceous filler (Si-F). Three families of mortars were designed to study: the effect of replacing Si-F with Nc-FA on mortars made with NA; the effect of replacing Si-F with Nc-FA on mortars made with 50% of NA and 50% of FRMA; and the effect of replacing Si-F with R-MF on mortars made with NA and FRMA. Replacing Si-F with Nc-FA is a viable alternative that increases the mechanical strength, the workability and durability properties and decreases the shrinkage. The use of FRMA and Nc-FA improved the mechanical strength of mortars, and it slightly increased the shrinkage. The replacement of Si-F with R-MF on mortars made with FRMA is not a good alternative, because it has a negative impact on all of the properties tested. This work can help both to reduce cement and natural resources' consumption and to increase the recycling rate of Nc-FA and FRMA.

Keywords: mortars; non-conforming fly ash; powdered addition; recycled aggregates; construction and demolition waste

1. Introduction

Coal is still a major fuel for energy production in Europe (EU-28). According to the Eurostat website [1], the member states of EU-28 consumed 308 million tonnes (MMt) of hard coal and 432 MMt of lignite in 2013. Pulverized coal is burned in thermoelectric power plants, where a big quantity of coal combustion products (CCPs) is generated. Depending on the coal's mineral components and the combustion technique, six different CCPs can be identified: fly ash (FA), bottom ash (BA), boiler slag (BS), fluidized bed combustion ash (FBC), semi-dry absorption product (SDA) and flue gas desulphurization gypsum (FGD). According to the European Coal Combustion Products Association (ECOBA) [2], approximately 105 MMt of coal combustion products (CCPs) will be produced in Europe