Mixed Cements for Environmentally Sustainable Concrete Types

Ružica Rosković
Ph.D.
Civil Engineering Institute of Croatia
Zagreb, Croatia
ruzica.roskovic@igh.hr

Marijan Skazlić
Assistant Professor
University of Zagreb, Faculty of Civil Engineering
Zagreb, Croatia
skazle@grad.hr

Summary

Effect of mineral additives admixed into cement is of great importance for the reduction in consumption of natural raw materials and energy sources and for the reduction in CO_2 emissions. In this research are shown experimental results from industrial production of reference cement and cement with optimal mineral additives (20 % slag, 10 % fly ash, 5 % limestone). Analysis of getting results shown that when mixed cement with 35 % of mineral additives is used in manufacture of concrete with targeted 28-day strength, savings in thermal energy and CO_2 emissions of about 32 % can be achieved relative to Portland cement containing no mineral additives. Beside that, the heat released during early age of hydration is much lower in case of concrete with mixed cement and thus the possibility of the occurrence of early-age cracks is lessen, which in the long way result in increased concrete durability.

Keywords: durability; heat of clinkerization; heat of hydration; mixed cement.

1. Introduction

The sustainability programme in cement manufacturing announced worldwide in 2004 is only one in a series of initiatives designed to speed up or promote the processes of sustainable cement production. The programme presents a joint initiative among producers to accept the production principles and measures supporting the integration of economic, social and environmental aspects.
Production of Portland cement clinker uses huge amounts of natural raw materials and fossil fuels resulting in very high rates of CO_2 emissions. The source of CO_2 emissions is mostly raw material decarbonization and fuel burning.

One of possible ways to reduce CO_2 emissions from the cement manufacturing process is, first of all, the use of secondary raw materials and fuel such as waste oils, automobile tyres, plastics, burnable portion of municipal solid waste, etc. [1,2,3]

Production of mixed cement is considered to be another way to reduce CO_2 emissions. The role of mineral additives admixed into cement is of great importance for the reduction in consumption of natural raw materials and energy sources and the resulting reduction in CO_2 emissions through lower a clinker portion. Mineral additives generated as by-products in other industrial processes are especially suitable as no valuable resources are wasted for their production. [2,4,5]

Due to specific qualities of particular materials used in cement or concrete, in the past few years the possibility of combined applications of such materials and their interaction have been investigated. [6,7,8]

Still, hydration properties of cement are most important for concrete quality, and researches into the influence of particular admixtures or their mixtures on concrete properties are particularly important. [9]

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