



Effect of high temperature on the compressive strength of self-compacting concrete (SCC) exposed to fire

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Abstract

Generally, concrete structures have a high fire resistance. After fire, it is of economic interest to reuse the structure after appropriate repair based on a reliable assessment of the residual strength. This paper presents an experimental study on the performance of self-compacting concrete (SCC) subjected to high temperature. Six SCC mixtures with different cement grade were made and the specimens of each concrete mixture were heated up to 5 various temperatures (27C°, 100C°, 200C°, 300C°, 400C°). In order to ensure a uniform temperature throughout the specimens, the temperature was held constant at the maximum value for 1 h before cooling. Upon finishing this work, important results on the effect of high temperatures on compressive strength of self-compacting concrete (SCC) were obtained, thus providing a major contribution for the recovery design of structures that had been subject to fire.

Keywords: self-compacting concrete, high temperature, compressive strength, fire.

1. Introduction

Self-Compacting Concrete (SCC) was introduced in 1989 by Professor Ozawa in Japan [1] and then developed by Bartos and Grauers [2] and Okamura and Ouchi [3]. This type of concrete is known for its improved rheological properties [4] and it can flow easily filling the gaps between reinforcement and corners of the moulds without vibration [5]. In recent years, the construction industry has shown significant interest in the use of Self Compacting Concrete (SCC). This is due to the improvements in structural performance, such as desirable workability, high strength and durability [6]. Use of Self Compacting Concrete (SCC) in the construction industry has been widely growing in the entire world and a good growth of use is predicted for it in the near future [7]. Therefore it is necessary to determine its long term properties and service performances, such as durability and fire resistance.

Concrete can be exposed to elevated temperatures during fire or when it is close to furnaces and reactors [8]. Up to now, the effect of elevated temperature has been studied mainly on vibrated ordinary and high performance concretes [9]. The few studies on Self Compacting Concrete (SCC) subjected to high temperature showed A number of physical and chemical nonreversible changes occur in concrete when subjected to high temperature. Concrete damage due to high temperature includes weight loss, reductions in strength and modulus of elasticity, and formation of cracks and large pores [10].

The aim of this study was to evaluate the behavior of Self Compacting Concrete (SCC) subjected to elevated temperature, by using locally available materials, thus six mixtures of Self Compacting Concrete (SCC) specimens were prepared. At an age of 28 days, the Self-Compacting Concrete (SCC) specimens were exposed to elevated temperatures up to room temperature, 200°C, 300°C and 400°C and The effects of elevated temperatures on compressive strength were determined. Upon finishing this work, important results on the effect of high temperatures on compressive strength of Self Compacting Concrete (SCC) were obtained, thus providing a major contribution for the recovery design of structures that had been subject to fire.