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Compressive Strength and Elastic Modulus of Slurry Infiltrated Fiber Concrete (SIFCON) at High Temperature

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Abstract

SIFCON is a special type of fiber reinforced concrete (FRC) with an unattached fiber matrix that gives the composite matrix important tensile properties and, due to its high fiber content, SIFCON also has distinctive and unique ductility and energy absorption properties. Higher temperature resistance is one of the most important parameters affecting the durability and service life of the material. In this research, the compression strength and elastic modulus of Slurry Infiltrated Fiber Concrete (SIFCON) were tested both before and after exposure to high temperatures. Two fire exposure durations of 2 and 3 hours are examined. In addition to room temperatures, three temperature ranges of 400 ° C, 600 ° C and 900 ° C have been introduced. The results of the experiment showed that the compressive strength and elastic modulus decreased after exposure to high temperatures. The drastically reduction of compressive strength took place with increasing temperature above 600 °C. While, the reduction in elastic modulus values is more significant than the decrease in compressive strength at the same fire flame temperatures. The residual compressive strength and elastic modulus at 900 °C were in the range of (52.1% to 59.6%) and (30.6% to 34.1%) respectively.

Keywords: SIFCON; Steel Fiber; Fire; Elastic Modulus; Compressive Strength.

1. Introduction

Slurry infiltrated fiber concrete (SIFCON) was initially developed in 1979 by Lankard Materials Laboratory, Columbus, Ohio, USA, by incorporating large quantities of steel fibers into reinforced cement composites [1]. SIFCON can be considered as a special type of fiber reinforced concrete (FRC) with a high fiber content where the fibers are molded and infiltrated with cement-based slurry or flowing mortar. Despite the high cost of SIFCON, it is more widely used throughout the world, especially in explosive and impact structures. This is because most of the mechanical and durability properties of these materials are better than those of conventional FRC [2]. SIFCON has a very good application potential in an areas where impact resistance and high ductility are required, especially in the design of the seismic retrofit, in the structures under impact and explosive effects and in the repair of the reinforced concrete structural element. In general, the conventional fiber reinforced concrete (FRC) contains fibers (1–3) % by volume, whereas (SIFCON) contains (4–20) % of fibers. Even though the current practical ranges from (4 to 12) % [3]. SIFCON matrix is a cement slurry or flowing mortar different from the aggregate concrete used in FRC. Thus, SIFCON's production varies from FRC, which is produced by adding fibers to the fresh concrete, while SIFCON is produced by infiltrating a bed of pre-placed fibers with cement slurry and tightly packed in the mold [2, 4].

The mechanical properties of SIFCON members are evaluated by Shanthini and Mohanraj [4]. The cement-based slurry used was a mixture of different percentages of cement, fly ash, silica fume and eco sand to soil. In this study, the

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