Residual Mechanical Properties of High Strength Self-Compacting Concrete with Reused Steel Fibers at High Temperatures

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Abstract

This work investigates the influence of adding reused steel fibers (RSF) on the properties of high-strength self-compacting concrete (HSSCC) exposed to high temperatures. The rheological, mechanical properties, and flexural stiffness of the studied concrete were tested. For heated samples, the tests were conducted after exposing the studied specimens to heating at temperatures of (300, 500, and 700°C) in a furnace for two hours. The results showed that adding 1% of RSF to SCC slightly reduces flowability, passability, and increases viscosity compared to plain SCC. There was an important improvement in the mechanical strength of HSSCC with the incorporation of RSF. Where the increase in compressive, flexural strength, and elastic modulus of FRSCC was about 12%, 39%, and 11%, respectively compared to SCC without fibers. The results also showed the highest impact of RSF incorporation into SCC was on the flexural stiffness at ambient temperatures. For heated specimens, experimental results showed a significant decrease in the studied properties with increased heating to 700°C. The decrease in compressive, flexural strength and elastic modulus were about 24%, 59%, and 75%, respectively of initial strength for SCC without fibers and about 23%, 60%, and 69% of initial strength for FRSCC after exposure to a temperature of 500°C. Heating SCC to 700°C led to more brittleness in addition to significant losses in its strength and density. It was found that the FRSCC specimens retained an increase in stiffness index about 45%, 35%, 50%, and 84%, respectively compared with SCC without fibers at 20, 300, 500, and 700°C. This experimental study clearly showed that the residual stiffness and mechanical strength of the FRSCC were higher than SCC without fibers at both ambient temperatures and when exposed to high temperatures.