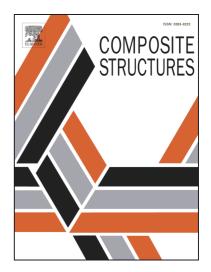
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Effects of fiber shape, aspect ratio, and volume fraction on flexural behavior of ultra-high-performance fiber-reinforced cement composites

Doo-Yeol Yoo^a, Soonho Kim^a, Gi-Joon Park^b, Jung-Jun Park^b, and Sung-Wook Kim^{b,*}

ABSTRACT

This study investigated the feasibility of reducing fiber content in ultra-high-performance fiber-reinforced cement composites (UHP-FRCC). For this, three different types of steel fibers were considered, and three different aspect ratios were applied for the case of straight fibers. To quantitatively evaluate the cost effectiveness of reducing the fiber content of UHP-FRCC, cost analysis was also performed. Test results indicated that at low fiber volume fractions ($V_f \le 1.0\%$), the twisted fibers provided the highest flexural strength, but they exhibited similar strength and poorer toughness than the straight fibers at a V_f equal to or higher than 1.5%. Smaller flexural strength and toughness were observed in the specimens with hooked fibers than those with straight ones at a V_f equal to or higher than 1.0%. In the case of straight fibers, the one with the highest aspect ratio was more effective in improving the flexural performance than those with lower aspect ratios. The medium-length straight fibers were most efficient at improving the flexural performance of UHP-FRCC at a V_f equal to or higher than 1.5%. The total production costs of commercially available UHP-FRCC are reduced by as much as 32–35% by replacing short straight fibers, with medium-length or long straight fibers.

Keywords: Ultra-high-performance fiber-reinforced cement composites; fiber type; aspect ratio; fiber volume fraction; flexural performance; cost analysis

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