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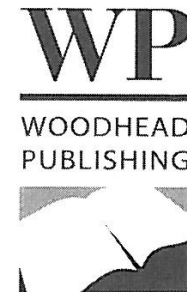
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Woodhead Publishing Series in Textiles: Number 104

Fibrous and composite materials for civil engineering applications

Edited by
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Part I

Types of fibrous textiles and structures

Steel fibre reinforced concrete: Material properties and structural applications

J. A. O. BARROS, University of Minho, Portugal

Abstract: Short and randomly distributed steel fibres are often used for concrete reinforcement since they offer resistance to crack initiation and, mainly, to crack propagation. In steel fibre reinforced concrete (SFRC) of low fibre volume content, the fibre reinforcement effectiveness is only significant after matrix cracking, since fibres crossing the crack guarantee a certain level of stress transfer between the faces of the crack, providing to the concrete a residual strength, the magnitude of which depends on the fibre, matrix and fibre-matrix properties. The mechanical performance of SFRC is also highly influenced by the fibre dispersion, since the effectiveness of fibre reinforcement depends on the orientation and arrangement of the fibres within the cement matrix.

Key words: steel fibre reinforced concrete, steel fibre reinforced self-compacting concrete, tensile behaviour, flexural behaviour, shear and punching behaviour, façade panels, inverse analysis, finite element method.

4.1 Introduction

The use of discrete steel fibres as a reinforcement system for cement-based materials is now a current practice for several applications (di Prisco *et al.* 2004). The resulting material is designated steel fibre reinforced concrete (SFRC). The post cracking residual strength can be much higher in SFRC than in the homologous (same strength class) plain concrete (PC), due to fibre reinforcement mechanisms provided by fibres bridging the cracks (Barros *et al.* 2005b). In consequence, SFRC allows high level of stress redistribution, providing a significant deformation capacity of a structure between crack initiation and its failure, which increases the structural safety. This is especially relevant in structures of redundant number of supports (Barros and Figueiras 1998). The level of the post-cracking residual strength depends on several factors, such as: fibre geometric characteristics, fibre material properties, concrete properties, and method of SFRC application. When well conceived, fibre reinforcement can replace totally, or partially, conventional steel reinforcement for the flexural and shear resistance of concrete elements (Casanova 1995; Casanova *et al.* 2000; Roshani 1996). The percentage of this replacement depends on the type of element, support and loading conditions.