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Electrochemical corrosion monitoring of steel fiber embedded in cement based composites

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Abstract

Steel fibers are commonly used in cement based materials for many applications such as floors, structural elements, repairing works, etc. The chloride-induced corrosion via ingress of seawater may become a risk for performance of the steel fiber reinforced cement based composites. Despite of few studies that have dealt with the corrosion behavior of steel fibers embedded in cement based composites, there are lack of information about the chloride-induced corrosion of steel fibers embedded with sufficient cover in non-cracked matrixes, reactive powder concrete, and especially polymer-modified cement based mortars. The open-circuit potential and corrosion current density of single steel fibers embedded in various cement based matrices were monitored after 200, 400, 600, 1200 wetting-drying cycles in 3.5% NaCl solution. The corrosion and microstructure analyses revealed that the steel fibers can be protected by a well-designed mixture, non-cracked matrix and sufficient cover. However, it could be corroded in long terms depending on the type and the dosage of the polymer latex used. In addition, the residual stresses in the deformed regions of the hooked-end steel fibers is critical in terms of the protection against to chloride-induced corrosion.

Keywords: Steel fiber, chloride-induced corrosion, wetting-drying cycles, cement based composites

1. Introduction

Unreinforced cement based materials are known as brittle construction products with low tensile strength. It is very well known that this drawback of cementitious materials can be mitigated by incorporating different types of discontinuous fibers. Steel fibers are most commonly used in cement based materials for applications such as pavements, slabs and also many structural elements

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