Self-monitoring Composite Rods for Sustainable Construction

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Abstract. This paper presents the development and properties assessment of braided reinforced composite rods (BCR) able to both reinforce and monitor the stress state of concrete infrastructures. The research study aims at understanding the tensile behaviour and self-monitoring ability of composite rods reinforced by a textile structure – braided structure with core reinforcement – for civil engineering applications, namely for concrete internal reinforcement, as a steel substitute, in order to improve structures safety and sustainability. Seven types of braided composite rods have been produced using an author patented technique based on a modified conventional braiding machine. The tensile properties of the braided reinforced composite rods were evaluated in order to identify the type(s) of fibre(s) to be used as core reinforcement. BCR have been tested under bending while the variation of the electrical resistance was simultaneously monitored.

Keywords: sustainability, composite rod, tensile, self-monitoring, concrete.

1 Introduction

The concrete construction industry deals every day with the deterioration of concrete structures which compromises its security, safety and construction sustainability. Nowadays a large number of bridges, buildings and other structural elements require rehabilitation and repair and its maintenance have become an increasingly serious problem.

The corrosion of steel reinforcing rebar is the dominant cause of concrete structure degradation. The most effective way to prevent corrosion of steel rebar is the use of a corrosion resistant reinforcing material, such as fiber-reinforced-polymer (FRP) composites. The types of fiber-reinforced-polymer composites best suited for the reinforcement of concrete are those providing high strength, high stiffness, and environmental compatibility with concrete.

Nevertheless, the interest in the sustainability of concrete structures has increased and monitoring and maintaining their safety has become a main goal. To achieve this main goal monitoring systems that can be applied to the reinforced concrete elements

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