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Abstract

Carbon Fiber-Reinforced Polymer (CFRP) Composites for Strengthening and Repair of Reinforced Concrete †

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The increasing need to optimize concrete infrastructures by increasing their life cycle and the sustainability of projects has led to the search for new materials, to new designs or to the repair of structures. One of the most common ways to strengthen and rehabilitating reinforced concrete structures is to reinforce them using carbon fiber composites, allowing them to maintain the desired level of performance.

These reinforcements are commonly used in the form of plates or mats by placing these composites on site, by conforming them to the profile of the structure to be reinforced, and by bonding them to the concrete surface by applying an adhesive to make the bond.

Thus, studying the production parameters of carbon fiber-reinforced polymers (CFRPs) and adhesive bonding to concrete is extremely important. CFRP composites can be made using two types of polymer matrices: thermoplastic or thermosetting. These materials have the following advantages: being lightweight, having low costs, having a high impact resistance, and being easily molded (conformed) to different concrete shapes. Continuous fiber composites with thermoplastic polymers have the added advantages that the matrix is recyclable and easy to repair and that the cost is potentially lower.

The objective of this work was to evaluate the performance of CFRP composites made with thermoplastic and thermosetting to compare both types of materials. Thus, these materials were analyzed in terms of their structural strength and their sustainability (solution with a longer and greener life cycle) as a reinforcement solution for constructions with concrete structures.

The performance was characterized in relation to mechanical (tension and bending) and physical (mass fraction, surface tension and microstructure) properties.

The results obtained show that CFRP-based thermoplastic composites have promising characteristics. Thermoplastic polymer composites with carbon fiber reinforcement are a greener (recyclable) solution that does not substantially decrease their performance.

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