CERIS : Civil Engineering Research and Innovation for Sustainability

Durability of GFRP composites produced by vacuum infusion for civil engineering structures

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Summary

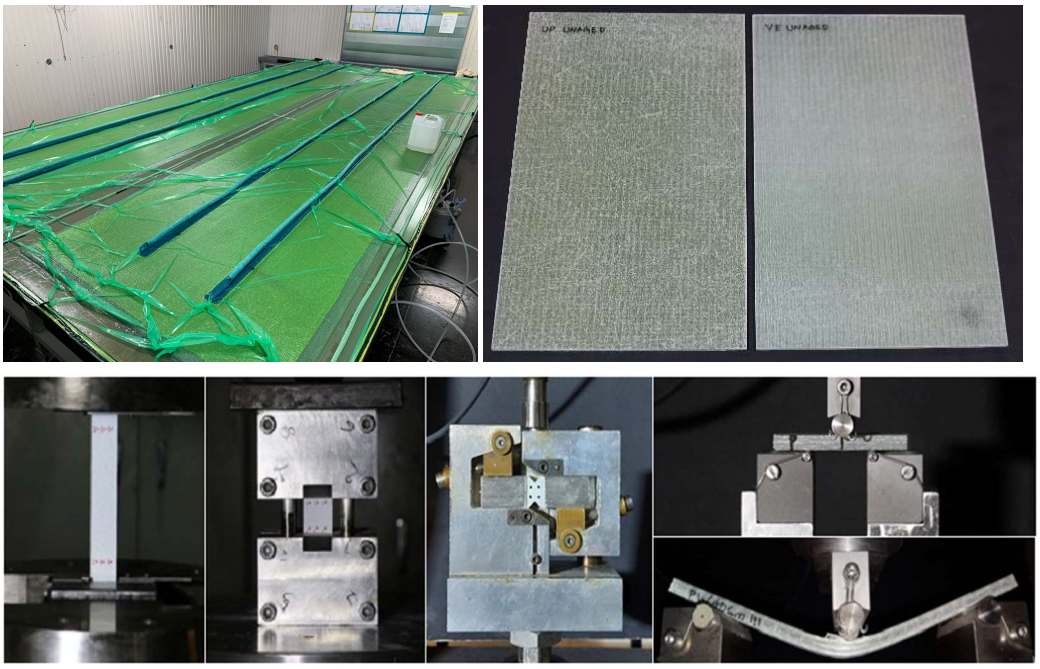
Fibre-reinforced polymer (FRP) composites have gained increased acceptance in civil engineering structural applications due to the various advantages they offer when compared to traditional materials, namely lightness, high specific strength and modulus, non-corrodibility, and low maintenance. However, there are various gaps in the body of knowledge about the durability of FRPs for civil engineering applications, especially for thick laminates produced by vacuum infusion.

The goals for this PhD thesis, set considering those gaps, are as follows: a) to obtain in-depth understanding of the durability of FRPs used in civil engineering, particularly those produced by vacuum infusion, by assessing the corresponding degradation mechanisms and relevance of synergistic effects; b) to provide a wealth of experimental data about the durability of FRPs, from laboratory (accelerated) and in-service (normal) conditions, for long periods of time; c) to develop an open-access and comprehensive database of validated durability test results; d) to develop water absorption models; e) to develop degradation models able to predict changes of physical and mechanical properties of FRPs subjected to different environmental conditions, and to correlate accelerated ageing with natural ageing; f) to draft codified recommendations for FRP durability design, including conversion factors, a harmonized framework for durability tests, and recommendations of good practice.

To achieve these objectives, a detailed experimental program has been designed. Vacuum infused FRP composite plates are being aged under different laboratory and natural conditions. After predefined periods, the aged and unaged materials will be tested in the laboratory to quantify the degradation in thermomechanical and mechanical properties. The data obtained from the laboratory tests will be used to develop degradation models, a durability database and design recommendations. This thesis will contribute to a widespread use of FRP in civil engineering structures, making a safer and more economic use of their significant advantages over traditional materials.

Keywords

Glass Fibre Reinforced Polymer (GFRP) composites, vacuum infusion, thermomechanical and mechanical properties, degradation models, durability, database, design recommendations.



Vaccum infused FRP lamiantes (top) and mechanical tests in tension, compression, in-plane shear, interlaminar shear and flexure (bottom).