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Monitoring of Smart Composite Materials by Optical Fiber Sensors: From Fabrication to Mechanical Characterization

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ABSTRACT

In this work, composite materials were instrumented by optical fiber sensors with the scope to monitor the instrumentation of pultruded profile made out of composite materials. Then after, using Fiber-Bragg Gratings, were used to monitor strain under quasi-static and fatigue loading under 3-point bending. Results show that optical fiber sensors perform well in either cases. The results that are reported are part of the French Program decid2 aiming at building a large dimensions plateform (20m x 3,5m, DECID2 Project).

KEYWORDS: Smart Composites, pultrusion, Optical Fiber Sensors (OFS), Fiber-Bragg Gratings (FBG), Structural Health Monitoring (SHM), Fatigue

INTRODUCTION

Polymer matrix composites are increasingly used as structures in various industrial fields. Their good mechanical properties, excellent corrosion-resistance, their rigidity/weight ratio higher than steels, their good processability and ease of manufacture are the main reasons for this success. However, there still remains some concern about their sustainability and environmental performance over the long term. It is therefore of a prime importance to develop suitable and reliable structural health monitoring technique that will enable fine estimates of strain in various localizations. The so-called smart composite concept is a promising technique to conventional monitoring techniques. Optical fiber sensors (OFS) are well suited to monitor the long term behavior of composite structures under various stress solicitations (see for Brady mentioned).

Optical fiber sensors (OFS) better fulfill the requirements of embedded sensors in composite materials than piezoelectric sensors. They offer a good thermal resistance and a high mechanical strength, especially under traction, which prevents

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