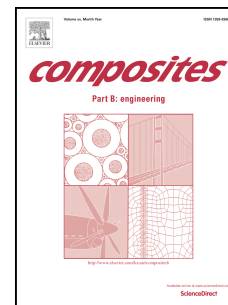


Accepted Manuscript

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PII: S1359-8368(17)30930-7

DOI: [10.1016/j.compositesb.2017.07.017](https://doi.org/10.1016/j.compositesb.2017.07.017)

Reference: JCOMB 5152

To appear in: *Composites Part B*

Received Date: 15 March 2017

Revised Date: 6 June 2017

Accepted Date: 13 July 2017

Please cite this article as: Malpot Amé, Touchard F, Bergamo Sé, An investigation of the influence of moisture on fatigue damage mechanisms in a woven glass-fibre-reinforced PA66 composite using acoustic emission and infrared thermography, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.07.017.

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An investigation of the influence of moisture on fatigue damage mechanisms in a woven glass-fibre-reinforced PA66 composite using acoustic emission and infrared thermography.

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Abstract

A woven glass-fibre-reinforced composite with a polyamide 6,6 matrix is considered for the purpose of being integrated into an automotive part. Fatigue tests were conducted on both $[(0/90)_3]$ and $[(\pm 45)_3]$ stacking sequences. In order to analyze the influence of moisture content on the fatigue behaviour, samples were conditioned at RH0, RH50 and RH100. Although moisture content affects the fatigue life for high stress levels, this effect tends to disappear for low stress levels. This phenomenon was confirmed by additional fatigue tests in a climatic chamber. This paper aims to investigate damage mechanisms developing within the material during fatigue test in order to understand the origin of this phenomenon. Two in-situ non-destructive techniques were used in order to detail the fatigue damage scenario: namely, acoustic emission and infrared thermography. These techniques allow locating and differentiating the main damage mechanisms: matrix cracking, fibre/matrix debonding and fibre breakages. In addition, microscopic observations and synchrotron X-ray microtomography were realized on fatigue coupons to visualize fibre breakages. Results have highlighted an increase in the amount of fibre breakage when the applied fatigue stress decreases, which explains the observed phenomenon.

Keywords: Woven composite, Influence of moisture, acoustic emission, infrared thermography

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