Accepted Manuscript

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Xavier Gabrion, Vincent Placet, Frédérique Trivaudey, Lamine Boubakar

PII: S1359-8368(16)30156-1

DOI: 10.1016/j.compositesb.2016.03.068

Reference: JCOMB 4169

To appear in: *Composites Part B*

Received Date: 27 November 2015

Revised Date: 17 March 2016

Accepted Date: 25 March 2016

Please cite this article as: Gabrion X, Placet V, Trivaudey F, Boubakar L, About the thermomechanical behaviour of a carbon fibre reinforced high-temperature thermoplastic composite, *Composites Part B* (2016), doi: 10.1016/j.compositesb.2016.03.068.

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Xavier Gabrion, Vincent Placet*, Frédérique Trivaudey, Lamine Boubakar

FEMTO-ST Institute, Department of Applied Mechanics, UMR CNRS 6174, University of Bourgogne Franche-Comté, F-25000 Besançon,

*Email: vincent.placet@univ-fcomte.fr

tel: +33 381.666.055 fax: +33 381.666.700

ABSTRACT

Novel high-temperature thermoplastic polymers offer potential advantages over thermoset ones and represent a promising alternative in advanced composite applications. This work proposes to determine the thermal properties and resistance of unidirectional carbon fibre reinforced thermoplastic polyimide composite and to characterize the influence of temperature on its mechanical behaviour and properties, including tensile properties, interlaminar shear strength and failure mechanisms. Characterization is performed on composite tapes and on ring-shaped specimens manufactured using a heated-head thermoplastic filament winding process.

Results show that the thermal degradation of such composite material occurs at temperature higher than 400°C. The glass transition temperature is approximately 250°C. The tensile strength is higher than 1200 MPa in the fibre direction on a temperature range varying from -50 to 250°C. The material has also an outstanding fatigue strength under tension in this material direction. At 200°C, the fatigue strength for a high number of cycles (2.10^6) is still approximately 50% of the static strength. One of the weak point of this composite laminate is the relatively low interlaminar shear strength at high temperature.

Keywords: A. Polymer-matrix composites (PMCs), B. Thermomechanical, D. Mechanical testing, E. Thermoplastic resin,