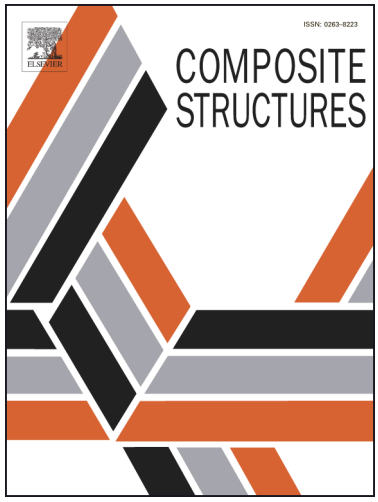

Determination of J-R curves by load separation criterion in highly ductile TP-based composites under high temperature conditions

M. Chabchoub, B. Vieille, M. Beyaoui, M. Taktak, M. Haddar, L. Taleb

PII: S0263-8223(17)30428-2
DOI: https://doi.org/10.1016/j.compstruct.2017.09.060
Reference: COST 8923

To appear in: *Composite Structures*

Received Date: 6 February 2017
Revised Date: 6 September 2017
Accepted Date: 20 September 2017

Please cite this article as: Chabchoub, M., Vieille, B., Beyaoui, M., Taktak, M., Haddar, M., Taleb, L., Determination of J-R curves by load separation criterion in highly ductile TP-based composites under high temperature conditions, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.09.060

Determination of J-R curves by load separation criterion in highly ductile TP-based composites under high temperature conditions

Chabchoub M., Vieille B., Beyaoui M., Taktak M., Haddar M., Taleb L.

[a] *Normandie Univ, UNIROUEN, INSA Rouen, CNRS, Groupe de Physique des Matériaux, 76801 St Etienne du Rouvray, France*

[b] *ENI Sfax - Laboratory of Mechanics, Modelling and Production, Route Soukra, 3038 Sfax, Tunisia*

* *Address correspondence to: Manel.Chabchoub@insa-rouen.fr*

Abstract

This work was aimed at determining the J-integral in 5-harness satin weave carbon fabrics reinforced PolyPhenylene Sulphide (PPS) structures at 120°C>Tg (glass transition temperature). The use of the linear elastic fracture mechanics (LEFM) framework to investigate the fracture behavior is not relevant in C/PPS laminates whose angle-ply stacking sequence is characterized by a highly ductile behavior. Thus the corresponding strain energy release rate (denoted J) in angle-ply laminates can be evaluated by means of the J-integral to account for the elastic-plastic fracture mechanics (EPFM). To this aim, a particular attention was paid to determine η_{el}- and η_{pl}- factors which are key points in the evaluation of J. η_{el} is classically evaluated using the compliance method, whereas, η_{pl} is determined by means of the load separation method applied to both elastic and total displacements. The comparison between initial crack length calculated using plastic and total displacement allows us to conclude that η_{pl}-factor based on total displacement leads to more accurate results. Using the S_{ij} parameter, it is therefore possible to estimate transverse crack growths for different initial notch lengths. The predicted crack growth is in a good agreement with the experimental evolution obtained using Digital Image Correlation (DIC). Finally, the present work provides the J-R curves of highly ductile composite systems for different initial crack length over width ratios (a/w).

Keywords: fracture mechanics, Single Edge Notched (SEN), load separation method, J-integral, high temperature