Accepted Manuscript

Tensile loading rate effect on mechanical properties and failure mechanisms in open-hole carbon fiber reinforced polymer composites by acoustic emission approach

Mohammad Azadi, Hassan Sayar, Ahmad Ghasemi-Ghalebahman, Seyed Mohammad Jafari

PII: S1359-8368(18)30906-5

DOI: 10.1016/j.compositesb.2018.09.103

Reference: JCOMB 6073

To appear in: *Composites Part B*

Received Date: 22 March 2018

Revised Date: 26 September 2018

Accepted Date: 29 September 2018

Please cite this article as: Azadi M, Sayar H, Ghasemi-Ghalebahman A, Jafari SM, Tensile loading rate effect on mechanical properties and failure mechanisms in open-hole carbon fiber reinforced polymer composites by acoustic emission approach, *Composites Part B* (2018), doi: https://doi.org/10.1016/j.compositesb.2018.09.103.

Tensile loading rate effect on mechanical properties and failure mechanisms in open-hole carbon fiber reinforced polymer composites by acoustic emission approach

Mohammad Azadi[1,*], Hassan Sayar[1], Ahmad Ghasemi-Ghalebahman[1], Seyed Mohammad Jafari[2]

[1]Faculty of Mechanical Engineering, Semnan University, Semnan, Iran

[2]Faculty of Mechanical and Energy Engineering, Shahid Beheshti University, A.C., Tehran, Iran

[*]Corresponding author, Email: m_azadi@semnan.ac.ir, Phone: +98-910-210-7280

Abstract

In this article, the effect of the tensile loading rate has been investigated on mechanical properties and failure mechanisms in open-hole carbon fiber reinforced polymer composites. For this objective, acoustic emission signals on standard specimens under tensile loading were acquired and analyzed by the wavelet packet transform (WPT) and the fuzzy C-Means (FCM) methods. Tensile tests were also performed on pure resin, pure fiber and composite samples, at different loading rates. Obtained results showed that by increasing the tensile loading rate, the maximum stress increased and the maximum strain decreased, in open-hole composite specimens. The frequency range of failure mechanisms including matrix cracking, the fiber breakage and debonding of fibers from the matrix was 100-250 kHz, 420-500 kHz and 250-420 kHz, respectively. In addition, debonding was the dominant failure mechanism in both WPT and FCM methods. Such results were also verified by scanning electron microscopy images.

Keyword: Tensile loading rate, Mechanical property, Failure mechanism, Open-hole specimen, Acoustic emission, Carbon fiber reinforced polymer composite, Scanning electron microscopy