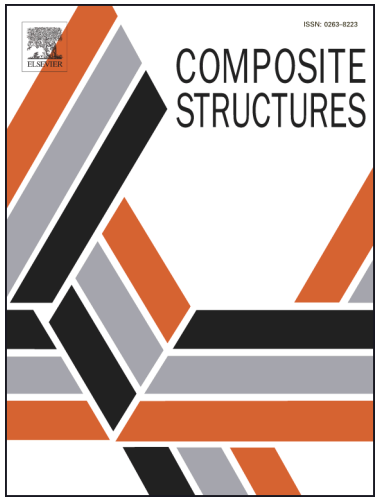

Investigation of interleaf sequence effects on impact delamination of Nano-modified woven composite laminates using cohesive zone model

H. Saghafi, S.R. Ghaffarian, D. Salimi-Majd, H.A. Saghafi

PII: S0263-8223(16)31786-X
DOI: http://dx.doi.org/10.1016/j.compstruct.2017.01.035
Reference: COST 8169

To appear in: *Composite Structures*

Received Date: 7 September 2016
Revised Date: 6 January 2017
Accepted Date: 12 January 2017

Please cite this article as: Saghafi, H., Ghaffarian, S.R., Salimi-Majd, D., Saghafi, H.A., Investigation of interleaf sequence effects on impact delamination of Nano-modified woven composite laminates using cohesive zone model, *Composite Structures* (2017), doi: http://dx.doi.org/10.1016/j.compstruct.2017.01.035

Investigation of interleaf sequence effects on impact delamination of Nano-modified woven composite laminates using cohesive zone model

H. Saghafi*[1], S.R. Ghaffarian*[1], D. Salimi-Majd[2], H.A. Saghafi[3]

[1] Department of Polymer Engineering and Color Technology, Amirkabir University of Technology, Hafez Ave. 424, Tehran 15914, Iran
[2] Young Researchers and Elite Club, Arak Branch, Islamic Azad University, Arak, Iran
[3] Department of Mechanical Engineering, Tarbiat Modares University, Tehran 14115-143, Iran

Corresponding authors:
hsaghafi@aut.ac.ir (H. Saghafi)
sr_ghaffarian@aut.ac.ir (S.R. Ghaffarian)

Abstract:

Applying nanofibrous mats between layers is one of the best methods for toughening of composite laminates. So far, many studies have been conducted for investigating the effect of various thermoplastic nanofibers on mode-I and mode-II fracture toughness, but limited studies have been done on the response and damage of interleaved laminates under low-velocity impact. Therefore, first, a laminate which its all ten layers interleaved by nanofibers is considered, then the influence of using five nanofibrous mats (half of the required mats to interleaved all layers) on delaminated area in different interleaf sequences is investigated. For this aim, the cohesive parameters of reference and Nylon 6,6-interleaved laminates (for mode-I and mode-II delamination) are obtained by numerical and experimental analyses and then the impact loading is modeled by ABAQUS/Explicit. The results show that utilizing Nylon 6,6 can decrease the delaminated area 60% if all layers of laminate interleaved by nanofibers. On the other hand, it is shown when there are five mats as the modifier, the best interleaf sequence belongs to the situation in which nanofibrous mats applied in the mid-layers of laminate.

Key Words: Composite laminates; Impact loading; Interleaving; Nanofibers; CZM.

1. Introduction:

In laminated composites, different damages such as delamination, matrix cracks, fiber-matrix debonding, and fiber fracture can be caused as a consequence of impact loading of foreign stuffs (in service conditions and maintenance operations). Delamination is one the most important failure among these damages which is easily made even in very low-velocity impact [1]. Because the delaminated area can propagate under service (especially under fatigue loading) and finally causes a