

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Biltu Mahato

PhD Program: Mathematics and Mechanics

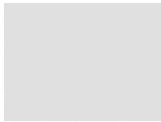
Title of Thesis: Multifunctional Interleaves for Composite Laminate

Supervisor: Dr. Sergey Abaimov, Skoltech

Co-supervisor: Professor Stepan Lomov, KU Leuven

Name of the Reviewer:

I confirm the absence of any conflict of interest



Date: 07-12-2023

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

This thesis has tried two types of modifications based on CNTs to fabricate the multifunctional laminates. The first modification is interleaving the polymeric veil produced by electrospinning of polymers, but it cannot achieve electrically conductive laminates. The second one is CNT interleave by diluting CNT masterbatch, which can exhibit good improvements on the mode I fracture toughness and electrical conductivity. The author gives detailed analysis of the mechanically toughening and electrically conductive mechanisms induced by CNTs, and further demonstrate the potential applications on damage sensing and in-situ cure monitoring. The author has published multiple journal publications, conference papers and patents, and I think these good publications has demonstrated the scientific importance of this thesis.

Other comments on this thesis are listed as follows,

(1) In several places in thesis, there are typing errors of punctuations. For example, fullstop is missing before 'since' on Page 72; semicolon is missing before 'hence' on Page 78; fullstop is not necessary after 5 °C/min on Pages 127 and 135. Please also check other parts of this thesis to avoid similar errors.

(2) In Chapter 2, SEM images from Figure 2.6 to Figure 2.10 show the PAN veil of different contents of CNTs. It is better to mark the PAN nanofiber and CNTs in the images, so that the reader can understand the effects of CNT additions on the network structure.

Figure 2.11 is not mentioned in the text. The effects of CNT content on the areal density of CNT-modified PAN veil are not clear. An explanation would be given.

In equations 2.2 to 2.5, some parameters like R are not defined, although the read can guess its physical representation.

In trial 2, the length unit is cm but it is mm in other parts. The same length units would be used in the whole thesis.

(3) In Chapter 3, for the HC interleaved laminates, the author mentions the lower part of the laminates has a smaller thickness than the upper part. A quantitative comparison is better to be given. The DCB tests show that interleaved CNTs lead to 27% and 0.5% improvement of initial and propagated mode I fracture toughness, respectively. For the former, are the results affected by unsymmetrical thickness of the HC laminate? The author would give some comments.

The author mentions several types of toughening mechanisms induced by CNTs, which are believed to have positive contributions to the initial mode I fracture toughness. Why do these toughening mechanisms not have similar contribution to the propagation fracture toughness?

According to Figure 3.11(b), the peak load of HC laminates is almost equal to that of baseline laminates, which cannot demonstrate the improvement of initial mode I fracture toughness.

(4) In Chapter 4, as for the cure monitoring, it is better to give a example to demonstrate how to calculate the degree of curing when the overall resistance is obtained.

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense