

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: 09-11-2023
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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

Assessment Report of Ph.D Thesis of Mr. Biltu Mahato

The Ph.D thesis entitled “Multifunctional Interleaves for Composite Laminate” has been evaluated. The novelty of the research has been effectively showcased through the design and creation of multifunctional laminates. This has been achieved by incorporating carbon nanotubes (CNTs) as interleaves in electrospun materials, improving Mode I fracture toughness and enhancing electrical conductivity. The ability of interleaved laminate to monitor the damage condition suitable for structural health monitoring applications has also been successfully demonstrated. The ability of CNTs dispersed in thermoset polymer has been investigated from an application perspective of multifunctional laminates. It has been found that a degree of cure exceeding 90% is essential for ensuring high strength. Therefore, closely monitoring the progression of cure development during composite manufacturing is deemed crucial.

Irrefutably, the research topic has undergone thorough investigation, making a substantial contribution to the current body of literature on electrospun and carbon nanotube materials. The PhD candidate has authored three journal articles, presented his work at numerous international conferences, and secured a patent, demonstrating the practical applications of the research work. There are a few grammatical and English errors that need to be addressed. In addition, the thesis needs to address the following **minor** corrections before the PhD degree can be awarded.

- Although the PhD candidate highlighted the novelty of the research work in several chapters, motivation/novelty must be added as a separate section in the Introduction.
- A section dealing with the clear-cut research objectives must be added to the thesis.
- Page no. 29, it should be “Such agglomeration...mechanical and functional **properties....**”
- ‘Non-woven’ should be replaced by ‘Nonwoven’ throughout the thesis.
- Although there is a list of acronyms in the thesis, it is better to clearly define them within the text.
- The caption of Figure 2.3 has some typographical errors, please correct it.
- Fibre diameter and, if possible, fibre orientation distribution of electrospun materials can be provided in the thesis.
- In the abstract, it is important to highlight whether SWCNTs or MWCNTs have been used in the research work.
- Please rationalise your results for the determination of fibre volume fraction in laminates, which are poorly cured.
- In Figure 3.11, there appears to be a discrepancy between the nature of force-displacement curves and the corresponding change in electrical resistance. Please justify. How many specimens exhibit this behaviour? What is the value of R^2 in Figure 3.12?
- A number of equations appear on page 129; kindly consider rationalising them and providing clear definitions for their symbols.

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