

## 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

(Alternatively, Reviewer can formulate a possible conflict)

**Date: 29-12-2023**

*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

The thesis submitted by Mr. Biltu Mahato contains 161 pages and is written interestingly, i.e., contains an introduction to set the scene and the goal, a concise but reliable background review followed by three chapters with their own “experimental sections”. Though this choice provides extra deep involvement in the topic flow, there is another side of the coin – the continuity of the whole thesis might be affected.

The relevance of the research is supported not only by publications in leading journals of the field (e.g., Composites Science and Technology) but also ever-growing implementation of more sophisticated composite materials. It should be stressed that, even in such a highly competitive field, the author was able to show a high level of results interesting for both fundamental and applied science. The hypotheses proposed must be confirmed with structural, mechanical, and microscopy methods used.

The integrity of the work is supported not only by the results of independent methods but also by the level of the journals and the conferences that indirectly verify the importance of the findings.

The author also indirectly shows his expertise in the outlook section to enlighten the pathway for future endeavors.

The following comments should be addressed prior the publishing.

- Carbon nanotubes are a wide family of materials. Should the author describe the following. How, for example, the number of walls or nanotube defectiveness might affect the properties of the final composite.
- Section 3.1 shows that three-roll milling was used to make the masterbatches at 10% by weight. This is because, at such high loading, the material becomes a solid and requires such advanced techniques. How was 7.5% by weight achieved by such simple procedures? What was the viscosity rating of the mixer and the 7.5% “interlayer”?
- Chapter 3.2.1 – shows that CNTs are dispersed in a matrix and the resultant nanocomposite matrix is then applied as a layer – why is this called an interlayer when it is a surface modification of the fiber reinforcements rather than a free-standing structure? In essence, CNTs are just painted onto the surface.
- For Figure 4.7 – how many isothermal and dynamic DSC scans were conducted to make such a smooth curve? They should be presented in the appendix section so that it is clear if the CNT interleaves influence the reaction kinetics and dynamics. Was there any signal-to-noise processing?
- Page 31: “However, they suffer from poor out-of-plane properties because interlaminar fracture toughness (FT) is provided, besides matrix, only by the partial fibrous involvement in the form of the fiber-bridging effect.” The sentence is unclear and possibly self-contradictory. Please comment.

#### 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*