

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Hassaan Ahmad Butt

PhD Program: Materials Science and Engineering

Title of Thesis: Carbon nanotube fibers as embedded electrodes for the dual-stage monitoring of multi-functional carbon nanotube nanocomposites

Supervisor: Professor Albert Nasibulin

Co-supervisor: Assistant Professor Dmitry Krasnikov

Name of the Reviewer: Dmitry Lyubchenko

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Date: 21-11-2023

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

- 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

The thesis is devoted to the application of carbon nanotube fibers as embedded electrodes for the one-step manufacturing and lifecycle monitoring of CNT-based nanocomposites. The nanotube fibers have shown the ability to detect various manufacturing defects, lifecycle damage and functional properties of CNT nanocomposites.

The goals and objectives to develop a novel technology for monitoring nano composite properties is clear. Results of this studies will have a great impact in nanotechnology manufacturing technology.

The thesis is well planned, structured, and written. The sufficient number of references is cited.

Good number of publications by the candidate indicate that the work is highly demanded and provides the scientific groundwork for further investigations into these advanced hierarchical nanocomposites and factors such as CNTF production technique, precursor quality, density, porosity, thickness and well as CNT type, functionalization and dispersion degree are now opened for further in-depth investigations.

The summary of issues to be addressed before the thesis defence:

Twistity effect – that is that and how does it affect the composite properties? More explanation is needed.

What is the physical reason of decreasing the conductivity vs. CNTF diameter in Fig.18?

Fig.23 tendency of changing is not clear, why?

Fig.27. why curves are so “noisy”?

Tendencies for 2 and 4 contact measurements are different. Is it due to the contact resistance?

In Conclusion section - “During the manufacturing cycle, the CNTF electrodes showed.....” Is the cycle a proper word, if yes, how many cycles of manufacturing were carried out?

Page 84, last sentence – “Comparatively, metallic embedded electrodes have the disadvantage of high noise”, - is it due to the contact issue? Explanations are needed.

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