

## 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:

<p>I confirm the absence of any conflict of interest</p> <p>(Alternatively, Reviewer can formulate a possible conflict)</p>	<p><b>Associate Professor, Alexey Yashchenok, Skoltech</b></p>  <p><b>Date: 17-11-2023</b></p>
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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

The present work represents the novel applications of carbon nanotube fibers as a type of embedded electrodes, which is capable of monitoring the physical properties of carbon-based nanocomposite materials both during the fabrication steps and after their preparation. This is state-of-the-art research, the results obtained during the implementation of the thesis are in line with data obtained by other scientific groups worldwide. In addition, part of the research conducted by the applicant was performed for the first time that supports the importance of the work. Furthermore, the obtained results have a great perspective to be practically implemented in industry in production smart, self-diagnostic and multifunctional nanocomposites. The high quality of the thesis is also supported by publication of the results of the research work in highly ranked international journals and presenting on several conferences.

After reading the thesis, there are questions and comments that should be addressed.

1. Chapter 3, Section 3.5.2: This chapter aims to give the main methods and materials that were used for sample fabrication and characterization. However, after reading the chapter, it seems that there is discussion of the experimental results along with the analysis of data. This somewhat make a confusion. It would be beneficial transfer discussion and analysis of data to related chapter of the thesis.
2. Chapter 4, Page 65: It would be informative give the description how mechanical properties, such as UTC, gauge factor, etc., were estimated.
3. Figure 28: The quality of the figure should be increased, since the insets are difficult to read.
4. Chapter 4, Page 53, Figure 19: Please revise figure number.
5. Chapter 4, Page 71, Figure 27: From the figure it is not clear, why the time laps is short for CNTFs? Are they destroyed?
6. From the test is it not clear that is the thickness of the carbon-based nanocomposite with embedded electrodes.

#### **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*