

Jury Member Report – Doctor of Philosophy thesis.


Name of Candidate: Mariia A. Zhiliaeva

PhD Program: Materials Science and Engineering

Title of Thesis: A novel straightforward wet pulling technique to fabricate carbon nanotube fibers

Supervisor: Professor Albert G. Nasibulin

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Signature:  Date: 16.11.2021
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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

The thesis of Mariia Zhiliaeva describes a thorough study on a novel wet pulling technique of carbon nanotube fiber manufacturing out of deposited CNTs. The method uses a combination of carbon nanotube film and solvent properties. During the fabrication process, the CNT film is soaked with the solvent and pulled by the tweezers. Then after densification, it forms a fiber. The method can be scaled up for large manufacturing lines and easily adaptive to different kinds of carbon nanotubes, as well as allows rapid fabrication and prototyping. The method developed in the thesis has a very good potential to advance into practical applications.

The work uses appropriate methods to investigate resulting fiber properties. Apart from the impressive fiber performance metrics, the candidate has been able to design various applications, including both passive and active electronic components. Above them, the adjustable force range sensor studied the best. Presented sensors' sensitivity (demonstrated in nanophone and heart rate monitor devices) makes it a promising candidate for the field of wearable electronics and soft robotics.

The thesis is clearly organized. It consists of 90 pages or 6 chapters, including a bibliography and appendices. The first chapter introduces carbon nanotube fibers and force sensing devices in general. The second one covers the methods used for the fiber preparation, characterization, and application design. The third chapter presents the wet pulling method, the resulted fibers parameters, possible fibers enhancements, and finally numerous applications. The fourth chapter summarizes and concludes the main point of the thesis.

I have a few minor comments and questions to be considered in an optional revision or during the defense

- Chapter 3.4 presents numerous applications. I wonder what are the advantages and disadvantages of the presented force sensor compare to other existing sensors.
- Chapter 3.4.1 describes the force sensor with adjustable force range. There is a lack of details of its actual force measuring limits.
- There are no any characterization of CNT used for the experiments. Is it possible to use any single wall CNTs for the sensors or there are some special requirements?
- The text layout may be improved. There are breaks between figures and figure captions, and empty pages.

The scientific level of the thesis results corresponds to the world-level state-of-the-art in the field, which is confirmed by the fact that the thesis already resulted in publications in two top rated journals in material science (Carbon (IF=9.6), Materials Science and Engineering B: Solid-State Materials for Advanced Technology (IF=4.0)) and a number of conference papers. In addition to its academic merit, I believe that the thesis results can and should be used to initiate some industrial projects.

I, therefore, recommend that the candidate is awarded the doctoral degree upon the successful defense of his thesis.

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