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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Javier Antonio Ramirez Benavides

PhD Program: Materials Science and Engineering

Title of Thesis: Advanced single-walled carbon nanotube membranes for optoelectromechanical applications

Supervisor: Professor Albert Nasibulin

Co-supervisor: Assistant Professor Dmitry Krasnikov

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Prof. Oleg V.Tolochko** **Date: 28-10-2024**

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

Recent thesis devoted to applications of advanced single-walled carbon nanotube membranes, which may be applied for filtration and for transparent electronics. It was shown that SWCNT renewable extreme ultraviolet (EUV) pellicle may be designed to filter and further evaporate Sn particles at a low pressure and the welding of membranes by ethylene decomposition on the membrane surface due to the high-temperature pyrolysis allows an improving the mechanical properties and electrical conductivity of films.

It should be notes that the topic of dissertation and experimental methods used in this study are relevant to actual content of dissertation and properly used according to actual research problems.

The quality of publications is quite high. Two papers with first coauthor-ship were published and submitted in Carbon (Elsevier) with impact factor 10,5 and Apple Physics Letters.

In his works, which are reflected in the thesis the author firstly shows the formal possibility to use freestanding CNT for membranes for optoelectromechanical applications. This is the most important results of his thesis. The increasing of UTS of CNT filters by welding without practical losses in optical transmittance, electric conductivity and filtering efficiency is also very important and significant result of the recent research.

The following items can be noted as shortcomings of the work:

- Some carelessness in the design of the work, for example, Fig.1 (f,g,h) exists, however there are no (f,g,h) in the figure caption; there no authors surnames in the Ref.1, etc.

- Too much attention was paid by the author to carbon modifications and nanotube synthesis methods, more than 30 pages in the thesis. However, this information has been already well known to researchers, who deals with nanocarbons. At the same time, only 5 pages show CNT membrane applications and aerosol protective pellicles. It is not enough for full understanding of problems of this research work.

- Why the author don not try 20 min welding? It would make an increase in the filtering efficiency and mechanical properties of membranes.

- Why does the equivalent sheet resistance R90 (Ω/□) of welded and doped CNT grow up that insignificantly? Is that in the frames of experimental error? Was there any statistical analysis of the results, how many samples were studied?

Finally, I want to mention that taking in account actuality and significance of research topic, high practical value of the results obtained, I recommend that the candidate should defend the thesis by means of a formal thesis defense.

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*