Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Ilya Novikov

PhD Program: Materials Science and Engineering

Title of Thesis: Assembling networks of single-walled carbon nanotubes for electronic and optical applications

Supervisor: Professor Albert Nasibulin, Skoltech
Co-supervisors:
Professor Tanja Kallio, Aalto University
Assistant Professor Dmitry Krasnikov, Skoltech
Assistant Professor Fedor Fedorov, Skoltech

Name of the Reviewer: Alexander M. KORSUNSKY

I confirm the absence of any conflict of interest	**Date: 06-09-2023**

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

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 addresses primarily matters of technological advancement of the procedures for the fabrication of SWCNT networks. To this end, controlled assembly of 2D SWCNT networks is reported to obtain thin SWCNT films that can be used as transparent conductive films in a variety of applications from electronics to sensors. In a subsidiary study, aspects are considered of SWCNT synthesis using CVD and related processes, and matters of optimisation are researched.

The second principal objective of the study is focused on SWCNT organization into a 3D network embedded within host polymer to obtain solid nanocomposite with desired conductivity that can find such applications in mechanical sensing (via the use of piezoresistivity) and electromagnetic field shielding.

Overall, the thesis is written well. In the beginning the introductory part is devoted to the overview of work in the field carried out to date, as well as summary of the key relationships that are further employed in the analysis. This is done in a fairly terse and sketchy manner that I feel is sufficient for readers closely acquainted with the scope of problems being addressed but could be made better grounded in the physics of CNT's for broader reader base.

The discussion of matters of fabrication and characterisation is presented well and reflects the substantial amount of work carried out by the candidate. Furthermore, the reader gets the impression that the work was mostly or exclusively done by the author, although some doubts arise when the phrases appear such as "we carried out investigation" etc. In this relation, the candidate is advised that in a Thesis it is best to avoid using "we", because the candidate's personal contribution is being assessed.

Generally, the work reported suggests that the project has been successful. However, I found it difficult to ascertain how novel the author's achievement has been. Since novelty of results is a principal measure of success for assessment, the author is advised to seek to make it abundantly clear exactly which results are being offered for degree defence as novel.

Finally, some idiosyncrasies of presentation are noted and could well be rectified in the final version fo the Thesis. Some notable cases are:

- The physical meaning and units of all constants and parameters that appearing in Eq.(7) should be explained
- There appears to be no explanation / justification given of the statistical aspect of SWCNT population distribution: why certain proportion is m, s, and hence why the proportion of junctions m-m, m-s and s-s , etc.

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*