Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis

Name of Candidate: Alexey Tsapenko

PhD Program: Physics

Title of Thesis: Enhancing Optoelectronic Performance of Randomly Oriented Single-Walled Carbon Nanotube Films

Supervisors: **Prof. Albert Nasibulin, Skoltech, Russia**

Prof. Esko Kauppinen, Aalto, Finland

Chair of PhD defense Jury: Prof. Nikolay Gippius, Skoltech ***Email***:N.Gippius@skoltech.ru

Date of Thesis Defense: October 4, 2019

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 10-08-2019**

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 the latest on August 13th. 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

Please write your statement / summary of issues to be addressed before the thesis defense here. 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 Doctoral Thesis by Alexey P. Tsapenko is devoted to the enhancement of optoelectronic properties of SWCNT. It has clear structure with the introduction chapter and review of state of the art the domain, followed by detailed description of the methods used in thesis research. The results are assembled in Chapter. 4 that is the largest part of the thesis. Thesis is well written and illustrated and overall quality is high.

The main goal of the presented research is the increase of the SWCNT films conductivity for given transparency by means of post-processing the films. The content of dissertation is relevant the topic of dissertation. The research performed during the thesis preparation is based on different methods well described in the in Chapter 3 of the thesis. All the methods are relevant for the research topic.

The SWCNT films are very complicated disordered structures with the optical properties dependent on the growth and post-treatment technology. The results of the thesis are valuable contribution to the overall picture of this complicated domain.

The results presented in Chapter 4.2 are very valuable for the applications as they show how the combination of SWCNT and graphene oxide can be used for high volume production of conductive transparent conducive films. The comparison of the obtained results with other approaches in Figure 4.2.1-5 shows high application potential of the prosed technology.

The results of the thesis are published in high quality articles and the role of Alexey P. Tsapenko in these works is well explained. I see no vital issues in the thesis. The minor comment is as follows. In Sec. 2.3.3 the calculations of the electronic properties of SWCNT using enhanced TB method with accounting for the excitonic effects are mentioned. It is not clear from the text whether the modification of the Coulomb potential in SWCNT compared to bulk materials was taken into account.

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*