

## Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Artem Grebenko

**PhD Program:** Physics

**Title of Thesis:** Carbon nanomaterials: synthesis and charge transport

**Supervisor:** Professor Albert Nasibulin

**Co-supervisor:** Dr. Dmitry Krasnikov

**Name of the Reviewer:** Anvar A. Zakhidov

I confirm the absence of any conflict of interest  (Alternatively, Reviewer can formulate a possible conflict)	<b>Date: 07-06-2022</b>
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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

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

- **Brief evaluation of the thesis quality and overall structure of the dissertation.**

Artem K. Grebenko dissertation is a deep and bulk work; it is well-structured and covers practical and fundamental aspects of the material science. Suggested novel synthesis techniques, charge transfer evaluation and patterning techniques, specific for the studied carbon nanomaterials are significant for the scientific community.

- **The relevance of the topic of dissertation work to its actual content**

Dissertation results are an intersection of material science chemistry and solid state physics, including synthesis and investigation of carbon nanomaterials. It is surely relevant to the PhD program of solid state physics in Skoltech.

- **The relevance of the methods used in the dissertation**

Methodology of the dissertation is adequate and facilitates the reported findings.

- **The scientific significance of the results obtained and their compliance with the international level and current state of the art**

All results described in the dissertation are competitive on the international level and are highly significant. The suggested graphene synthesis technique results in an ultra-high purity graphene, probably, one of the best among the published before. Patterning ultra-densification technique is an unusual and cunning approach towards dry lithography techniques to fabricate optically active structures out of the meshy ensembles of nanomaterials. Broadband spectroscopy results obtained from macroscale samples, accompanied by charge transfer measurement performed on individual elements and microscopy reveal important knowledge about the charge carrier dynamics in carbon nanomaterials.

- **The relevance of the obtained results to applications (if applicable)**

Suggested CVD techniques can be scaled and developed to meet the requirements of contemporary microelectronics industry.

- **The quality of publications**

Mr. Artem Grebenko's dissertation is based on a high-level Q1 publications. Three first author publications are published in top journals related to the physics and chemistry of carbon nanomaterials – Advanced Science, Small and Carbon.

I recommend the acceptance of this thesis, and I would like the author to answer the following questions:

1. What is the origin of a Lorentzian-like absorption line in THz graphene spectrum? Did the author conduct a research to understand its nature?

2. Can the suggested ultradensification patterning technique be transferred to SWCNT/MWNT forests?

**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*