

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:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Date: 02-06-2022
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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

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

Dissertation "CARBON NANOMATERIALS: SYNTHESIS AND CHARGE TRANSPORT" by Artem Grebenko is a high-quality manuscript written in a concise and clear manner. The document is well structured, and logically describes all relevant parts of the undertaken research. It begins with sample fabrication, its characterization, and progresses to the description of the new design methodology. Each chapter is based one or more publications, and includes the literature review. The research presented in the thesis is of high quality and satisfied the rigorous standards of a Skoltech PhD.

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

Dissertation topic reflects the actual content. Its structure follows the title and covers several important fields of material science and condensed matter physics.

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

Scientific methods used in this research are relevant and clearly described. They include crystal structure and morphology measurements techniques, electronic band structure measurements approach, and charge transfer measurement methods.

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

The results of the thesis are of fundamental and practical importance for the rapidly developing field of nanomaterials: i) The work develops a novel synthesis technique, and investigates its underlying physical mechanisms. ii) In the study of the charge transfer phenomena the author employs different techniques, which are complementary to each other, and therefore is able to find a deeper understanding of the observations. iii) the author suggests novel patterning techniques. The developed new methods and findings are valuable.

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

The results relevant to applications are described in Chapter 3, devoted to the novel synthesis approaches. The most practically valuable achievement is the novel graphene CVD technique, in which carbon monoxide is used as a carbon source gas, resulting in industrially important simplification of the CVD set-up.

- **The quality of publications**

The results of the research presented in the thesis have been published in top-tier journals, such as Advanced Science, Small, Carbon, IOP Nanotechnology and others.

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

1. The super-poissonian noise in a single-carbon nanotube is an interesting phenomenon, can the author comment a bit more on the nature of this observation? Is the author aware of shot-noise measurements in graphene micro- and nanostructures? Can the super-poissonian noise be observed in graphene? What is the typical value for the Fano factor of a ballistic graphene?
2. Can you please elaborate more on the distortion of the Coulomb diamonds?
3. Can you please explain the discrepancy between quite low scattering rate and mobility values extracted from the Hall effect measurements for the case of graphene FETs?

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