

## Jury Member Report – Doctor of Philosophy thesis.

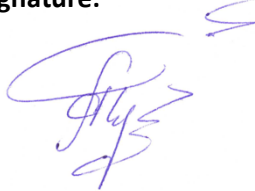
**Name of Candidate:** Aleksandra Boldyreva

**PhD Program:** Materials Science and Engineering

**Title of Thesis:** Unraveling bulk and interfacial degradation mechanisms in perovskite solar cells

**Supervisor:** Prof. Pavel Troshin

### Name of the Reviewer:

<p>I confirm the absence of any conflict of interest</p> <p>(Alternatively, Reviewer can formulate a possible conflict)</p>	<p><b>Signature:</b></p>  <p><b>Date: 03.06.2020</b></p>
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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

The resented Doctoral Thesis “Unraveling Bulk and Interfacial Degradation Mechanisms in Perovskite Solar Cells” by Alexandra Boldyreva is devoted to a very hot and important topic - perovskite solar cells. In spite of tremendous recent success have achieved in the field of perovskite photovoltaics and rapidly increasing efficiency of the cells, operation stability is not yet a solved problem. Interfaces between adjacent functional layers and in the bulk of perovskite material are still a big and seriously limitation for practical implementation of the perovskite solar cells. Alexandra Boldyreva’s thesis explore this practically very important and challenging task - the degradation effects in the perovskite solar cells.

The thesis consists of five chapters set forth on 147 pages. The thesis describes main results published in the papers, logically structured, however could be slightly improved. My comments related to the thesis structure:

- The list of figures and tables (p.11-15) is not necessary, and can be easily cut off without harming the quality of the thesis. This is old style, I would call atavism.
- Each experimental chapter contains sections Materials and Methods and Personal Contribution. I propose to make a separate chapter Materials and Methods, where everything can be described at once. Personal contribution can be described right after the list of thesis publication. Personal contribution is relevant not for chapters of the thesis, but for publications.
- Formulas and equations are part of the sentences and should follow the punctuation rules: commas and full periods are missing.

Some additional and more specific comments to improve the thesis:

- p.5: two first references are missing journal titles.
- p.25: “M. Saliba et. al have” should be replaced by “ Saliba et al. have”.
- Tables 2 and 3: please check the precision of all numbers: how many digits after dots are defined?
- 105: Figure 54 is separated from the figure caption.
- Figure 60: meaning of the map color is missing.
- Bibliography: please carefully check all the references, some of them lacks important information, e.g. ref. 13 misses proper author’s names; refs 23 and 33: do not contain DOI number...

The dissertation is based on six co-authored publications, in four of which Alexandra contributed as the first author. The papers are published in high quality journals with high impact factors: Sustainable Energy Fuels (4.912), ACS Appl. Mater. Interfaces (8.456), two papers in J. Phys. Chem. Lett. (7.330), J. Mater. Chem.-A. (10.733) and one paper is submitted. The number and level of publications as well as the position of the PhD candidate in the co-author’s list apparently show her strong contribution to the research field.

In general, the contribution of Alexandra Boldyreva to the field of photovoltaics based on perovskite is important and substantial. The dissertation is written in a very good scientific language, very accurately with practically no orthographic misprints and errors. Alexandra carried out most of the work, contributed to fundamental studies of the dissertation, and wrote the most part of the papers, which are the basis for his dissertation. She has sufficient number of scientific publications on the same as dissertation topic. Alexandra Boldyreva’s dissertation is an original work possessing fundamental novelty and practical importance. I strongly recommend the author of this thesis for the PhD degree. The manuscript can be accepted for publication as a doctoral dissertation after minor changes.

**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*