Skoltech
Skolkovo Institute of Science and Technology

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: Eugene A. Katz

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 05-06-2020**

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 topic of the PhD project and the dissertation of Alexandra Boldyreva is of vital practical and fundamental importance: (1) Development of perovskite-based photovoltaics is one of the most “hot” topics in research for solar energy conversion; (2) Poor operational stability is the main bottleneck for the industrial realization of this technology; (3) Understanding degradation mechanisms (with a special emphasis to interface phenomena) is the key issue for the development of stable perovskite devices.

The thesis is well structured and clearly written.

The novelty of the results has no doubt and confirmed by five high-quality publication in the premier (high impact-factor) scientific journals. The leading role of Alexandra Boldyreva in this research is confirmed by the fact that she is the first co-author in four papers.

A wide range of the experimental methods is completely relevant to the realization of scientific tasks of the PhD research.

Among the main scientific results of the research are:

(1) Elucidating interfacial degradation pathways at the interfaces between the methylammonium lead iodide (MAPbI3) and various charge transport layers (CTL).
(2) A systematic study of the degradation of the devices comprised by a hole-transport layer of four different compositions and the perovskite photoactive layer of five different formulations as well as the identification of the most stable device architecture.
(3) Radiative stability of perovskite solar cells for space applications.

Structure and quality of this dissertation completely satisfy to the requirements for PhD thesis.

Provisional Recommendation

X *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*