

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Mayuribala Mangrulkar

PhD Program: Materials Science and Engineering

Title of Thesis: Design and engineering of additives for improving the stability of hybrid perovskite solar cells

Supervisor: Professor Keith Stevenson

Name of the Reviewer:

I confirm the absence of any conflict of interest Juan-Pablo Correa-Baena (Alternatively, Reviewer can formulate a possible conflict)	09-15-2021 Date: DD-MM-YYYY
---	--

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

Halide perovskites suffer from fast degradation under environmental conditions. The perovskite can decompose into either PbI_2 , metallic lead or some volatile species, and this decomposition or transformation leads to the negative effects on the optoelectronic properties of the perovskites. This thesis investigates additives that can improve the long term stability of MAPbI_3 . Thin-film stability was tested and solar cell fabricated to investigate their operational stability under illumination. The work is meticulously carried out and well presented. The experimental plans are solid and the conclusions are important to the community of solar cells.

The topic of the dissertation is in line with what is presented in this thesis document and the experimental methods used to assess the solar cells and the halide perovskite materials are in line with the state of the art.

The results shown in this thesis are moderately impactful. There is solid characterization work on MAPI with some additives investigated. However, there is a lack of depth on the conclusions drawn from the studies presented. It seems that student made some experiments, characterized them but did not have a clear hypothesis to prove or disprove. Lack of a scientific question in each of the projects is an issue which I believe would make this thesis, and his overall research, more impactful to the community. In other words; what is the student trying to answer in terms of materials understanding? This is more impactful than: "I made solar cells with additives and they performed better or lasted longer", which is weak in the foundational aspects of materials science and which is what is highlighted throughout the thesis.

The research is very well tied to applications. No issues there.

The publications, as with the thesis, lack in depth fundamental understanding of materials science questions such as structure-property relationships.

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