

Jury Member Report – Doctor of Philosophy thesis.

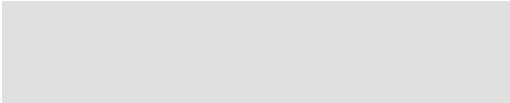
Name of Candidate: Nikita Akhmetov

PhD Program: Materials Science and Engineering

Title of Thesis: Development of lithium-conducting polymer-ceramic membranes for lithium-metal hybrid flow batteries

Supervisor: Professor Keith Stevenson.

Name of the Reviewer: Yongdan Li

 I confirm the absence of any conflict of interest.	Date: 30-09-2023
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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 thesis of Nikita Akhmetov on a topic "DEVELOPMENT OF LITHIUM-CONDUCTING POLYMER-CERAMIC MEMBRANES FOR LITHIUM-METAL HYBRID FLOW BATTERIES" is generally well written with well designed chapters and subtopics. The statement is clear and concise, well addressed the concerns of the topic. The topic is informative, the abstract summarized the contents, the self-introduction and other pre-chapters are necessary. The literature review well reflected the state of the art of the topic and focused on the research work carried out in this thesis. The chapter "Experimental details" gives all the necessary information of the methods and conditions used in the research work. The own work focuses on the composite membrane and the utilization of the membrane in the hybrid flow cell. The research out put is significant, achieving good performance with the hybrid battery, high coulombic efficiency, durability and reservation of the battery capacity. The publications involved are of high quality and well in front of the international level of the current state of the art.

Non-aqueous redox flow battery (NARFB) is a future large scale energy storage device, which may deliver high energy efficiency and high energy density. Therefore, to be targeted as the buffer of the intermittent renewable power energy sources. A great effort in the scientific community has been devoted to the development of these NARFBs. One of the key challenges is the separator (membrane) for such batteries due to the novelty of the reaction system. This thesis work made a useful exploration in this direction and achieved good results. However, the direction of further improvement should be pointed out:

1. The LATP+PVdF is a good design, but the ionic conductivity should be still improved to facilitate the large-scale energy storage targets.
2. The literature review part may be improved if a clearer description of the history of NARFB and the associated membrane is adopted.

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