Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Aleksandr Kurilovich

PhD Program: Materials Science and Engineering

Title of Thesis: Oxygen Reduction Reaction on Metal Oxides/Carbon Composite Materials

Supervisor: Professor Keith Stevenson

Name of the Reviewer: Tanja Kallio

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 25.08.2020**

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

Doctoral thesis of Mr. Aleksandr Kurilovich focuses on understanding the kinetics of the electrocatalytic oxygen reduction reaction (ORR) by combining multiscale modeling and experimental data. The results are logically presented and describe development of microkinetic models for different electrocatalysts and discusses the experimental data needed to verify the models. Both complex realistic electrocatalyst and model systems promoting less complex reactions as reactions of the intermediates are consider to evaluate the reliability of the developed models and to understand the issues related to the diversity of the experimental data. Hence, the thesis does not only provide new knowledge of the ORR mechanism but also critically assesses the used methodology. Overall, the selection of methods and their critical evaluation is one of the strengths of the doctoral thesis by Mr. Aleksandr Kurilovich.

The selected topic, understanding of ORR kinetics in alkaline media, is important for the field of electrocatalysis and energy conversion as ORR is often the limiting reaction in energy conversion applications and hence detailed insight is badly needed. The thesis comprises of three publications published in respected international journals and one submitted manuscript is of internarial high quality which evidenced its international high quality. The obtained results extend well beyond the state of the art by revealing interesting details on the interaction of the reactants and electrocatalysis during the ORR. The new insight can be used to further develop electrocatalysts for this complex reaction, which is met in several practical applications such as fuel cells and metal air batteries.

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*