

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Sergei Porokhin

PhD Program: Materials Science and Engineering

Title of Thesis: Perovskite mixed oxides as catalysts of oxygen evolution reaction

Supervisor: Professor Artem Abakumov

Co-supervisor: Assistant Professor Victoria Nikitina

Name of the Reviewer: Sergey Tsybulya

I confirm the absence of any conflict of interest

Date: 08-09-2022

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 development of renewable and environmentally friendly energy is one of the strategic directions for maintaining the energy balance in the near future. The catalytic process of electrochemical splitting of water is rightly regarded as a promising technology in the development of energy. The use of 3d metal oxides as catalysts for the reaction of oxygen evolution in alkaline media makes it possible to expect an increase in the efficiency of this process, which is a necessary condition for its practical application. Therefore, studies aimed at improving the efficiency of oxide catalysts are very relevant and in demand. In the work under review, the main attention was paid to the study of the electrocatalytic properties of perovskite based on NiFe with heterovalent substitution of Ca²⁺ for La³⁺. These oxides had not been sufficiently studied prior to the author's work. The topic of the dissertation is fully consistent with its content. The thesis presents an extensive literature review covering all aspects of the problem. The formulation of the objectives of this work follows logically from the analysis of the literature data. A very interesting result obtained in the experimental part of the study is the synthesis of perovskites in the form of spherical hollow particles using a modified synthesis technique. In the course of catalytic tests, the effect of calcium doping additives on the catalytic properties of these oxides was studied. Important results of the work should also include the conclusion about the stabilizing role of iron cations in the electrolyte during the course of the electrocatalytic reaction. These and other results of the work are original, which is confirmed by publications in journals with high international ratings. It should be noted the high level of research using the most modern and appropriate experimental and computational methods for solving the problems. There are no significant comments on the structure and content of the work. In general, the work makes a very good impression. The author deserves to be awarded the required degree.

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