

## Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Patrick Aggrey

**PhD Program:** Materials Science and Engineering

**Title of Thesis:** Nanoscale phase separation and transformations in the silicon-oxygen and related systems

**Supervisor:** Professor Alexander Korsunsky

**Co-supervisor:** Alexey Salimon, Senior Research Engineer

**Name of the Reviewer:** Dr. Maria Kandyla

I confirm the absence of any conflict of interest  (Alternatively, Reviewer can formulate a possible conflict)	<b>Date: 29-05-2023</b>
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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 quality is very high and the structure of the dissertation provides a logical sequence of hypotheses, experiments, results, further experiments, analysis, and conclusions. The thesis is clearly written and separated in distinct, but related, topics around the main theme of this work. The structure helps the reader follow the breadth of experimental work and the validity of conclusions.

The content of the dissertations is entirely relevant to the topic.

The methods used in the dissertation are perfectly suitable for the study of the materials and physical mechanisms investigated. They constitute a complete methodology for the topic of the dissertation and they provide complementary findings, in order to fully understand the physical effects and their results towards technological applications. No methodology gaps are present in the thesis.

The results are significant because they present low-cost, simple, and scalable methods for processing and texturing silica and silicon systems at the macro and nanoscale. They complement significantly the state of the art on this topic, which consists of several chemical and physical methods of processing and texturing silicon and silicon-oxygen systems, each with their own advantages and disadvantages.

The results are related to applications of the silicon technology in the fields of batteries and optoelectronic devices, such as photodetectors and LEDs. Potential applications could also take advantage of the porosity of the structured materials, for example in gas storage and other fields.

The Ph.D., candidate has published 3 papers in high-impact factor journals as a first author, demonstrating high quality of publications as a primary author.

Summary of issues to be addressed:

1. In Section 2.2, Heat Treatments, maybe the differences between calcination and roasting can be clarified by describing in more detail each method.
2. In chapter 3, Fig. 12a, the signature of opal must be explained in the text right above the Figure because only the quartz peaks are denoted in Fig. 12a.
3. What is the broad peak at low angles in chapter 3, Fig. 19, last row?
4. In chapter 3, Fig. 22b, from what type of silica is the anode derived? Pristine, roasted, or calcined?
5. In Fig. 23b, the reference must be provided.
6. At the top of p. 84, where the doping results of Si nanoflakes are discusses: what were the electric properties of the original Si substrate, was it n or p doped and how much?
7. In Fig. 34, scale bars are missing.

#### **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*