Skoltech
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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Zhanna Kozyreva

PhD Program: Materials Science and Engineering

Title of Thesis: Fluorescent photoconvertible polymer microcapsules for cell labeling and tracking

Supervisor: Professor Gleb Sukhorukov

Name of the Reviewer: Professor Li Shang

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	 **Date: 02-09-2024**

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

This thesis mainly focuses on addressing the challenges in developing usable fluorescent probes for cell labeling and tracking purposes. By optimizing both the synthesis methodology and the structures of photoconvertible microcapsules loaded with fluorescent dyes, key parameters influencing the optical property and cell imaging performance of these photoconvertible probes have been elucidated. Potential usage of optimized probes in cell imaging has also been well demonstrated. Overall, the topic of this thesis is interesting and important, and the whole dissertation is well structured and presented. Results obtained from the relevant study can provide useful knowledge for researchers working in the field of optical probes, cell imaging as well as cell biology. The quality of the thesis meets the level expected for a PhD degree in Materials Science and Engineering, so the defense is recommended.

A few concerns regarding to the contents of the thesis are listed in the following for the applicant to consider:

(1) The role of PVA gel in enhancing the property of photoconvertible microcapsules has been mainly attributed to the increase of viscosity during the hydrothermal synthesis in the discussion of Chapter 4. How about other polymers with similar property? What if replace PVA with other substances that can increase the viscosity of the solution?

(2) Two different types of photoconvertible microcapsules have been prepared: one is prepared by hydrothermal treatment with dyes physically encapsulated (Chapter 4); one is prepared by chemically modifying dyes to polymers without hydrothermal treatment (Chapter 5). Then, why choosing the materials prepared by the first strategy for cell imaging experiments in Chapter 6? What will be their advantage compared with these prepared by the second strategy?

(3) In the cell experiments, the results showed that no microcapsules were observed to transfer from mMSCs to EPNT-5. Cells are known to have an exocytosis machinery for foreign substances. So, it is interesting to know why these microcapsules can retain inside the cells without being excreted for such a long time.

(4) How was the number of microcapsules determined in the study? Experimental parameter for performing the photobleaching study in section 5.7 is also missed. Relevant details should be given clearly.

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*