Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Pavel Proshin

PhD Program: Materials Science and Engineering

Title of Thesis: Films with pattern-placed drug for use in personalized medicine

Supervisor: Professor Gleb Sukhorukov
Co-supervisor: Professor Alexander Korsunsky

Name of the Reviewer:

I confirm the absence of any conflict of interest Prof. Chaobin He, (Alternatively, Reviewer can formulate a possible conflict)	**Date: 25-09-2024**

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

The thesis titled "*FILMS WITH PATTERN-PLACED DRUG FOR USE IN PERSONALIZED MEDICINE*" by Mr. *PAVEL PROSHIN* centres on the development of multi-functional films as drug delivery systems. The thesis consists of 4 main parts, 1) introduction to drug delivery system, in particularly for the application as personalised medicine; 2) describe methods in the preparation of the functional films using 3D printing method and materials consideration; 3) Discuss different approaches to achieve controlled delivery, using condensed film as diffusion barrier, using pore as new delivery channels, using porogen to in-situ generate pores and also investigating the stability of such functional film under e-beam irradiation which is an important step for implant devices sterilisation, and finally this chapter also introduce a multilayer films which could be loaded with different drugs for combinational/sequential delivery ; and 4) investigate the adhesion of the developed functional film on the implant devices.

The quantity and the quality of the work are sufficient for a Ph.D. thesis while some revisions to the thesis are needed before the Ph.D. degree could be awarded.

Recommendation: Accept the thesis, but some amendments are required. The thesis must be revised in the light of my comments to the satisfaction of the supervisors.

Following are my comments on the thesis:

General comment: the thesis is well written with detail introduction and short summary.

More Specific Comments:

1. Any limitation for using the 3DP method for protein drug? As protein is thermal sensitive and the interaction with substrate will also alter the conformation of the protein.

2. P92. How to control the wetting of PVA/Drug solution on subtract? As there are many parameters such as printing speed, temperature, solvent, molecular weight of PVA. that could affect the fidelity of printed shape. How do you optimize the whole printing process?
3. P97, it seems that you use hydrophilic drug in this study, which could be dissolved in water and mix with PVA. How about if the drug is hydrophobic? Any polymer systems you need to be modified to accommodate the hydrophobic drug?
4. P97, why addition of PVA could limit the crystallization of Cefazolin? Any science behind? PVA is also a semi-crystalline polymer. Need to confirm if the surface roughness is due to the crystallization of drug or to PVA. Better using XRD to conduct analysis.
5. When using SEM to study the morphology of polymer film, the high vacuum environment may alter the morphology of the polymer film if the PVA is still in gel form. It is recommended that ESEM may be used if possible.
6. P122, it is suggested to quantify the contribution from diffusion through barrier film and via "hole". If the "hole" mechanism is dominated, you may choose other type of polymer for coating.
7. P127, it will be better to have a cross-section SEM of the film to ascertain if the PVP is clustered on the top of the surface.
8. P138, PVP is used as porogen, it is suggested that a porosity of the film to be determined.
9. The pore morphology is also important. If the pores are isolated "island" phase, (not interconnective) the drug releases will depend only on the diffusion of the polymer matrix, albeit at a thinner film.

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*