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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Timur Ermatov

PhD Program: Physics

Title of Thesis: Optical properties of hollow-core microstructured fibers modified by polymers and/or inorganic nano- and submicron particles

Supervisor: Professor Dmitry Gorin

Name of the Reviewer: Andre Skirtach, University of Ghent, Ghent, Belgium

I confirm the absence of any conf lict of interest 	**Date: 27-09-2021**

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

In his doctoral thesis, Mr. Timur Ermatov has conducted research work investigating different functionalization techniques applied for fabrication of advanced, in regard with sensing, coatings based on hollow-core fibers. Research area of optical fiber-based sensors is rapidly growing enabling development of novel and advanced devices with a broad range of potential and real applications. Thus, the study performed by the author is in the interest of the scientific community. The publications in the well-rated journals also justify the good quality of the research.

Analyzing material of the thesis in more details, the title of the dissertation and the area of his specialization directly relate to the content of the thesis. And they are centered on the producing fiber-based optical sensors for biophotonic applications. The light guidance in optical fibers has been characterized both experimentally, employing scrupulous measurement, and theoretically, using advanced modeling and simulation. The measured optical transmittance is compared with the developed model and is applied for fibers of various geometries.

The results are presented in a structured way with detailed description of experimental methods.

The material is solid and is presented in a cohesive and organized way. However, I found few points that need to be addressed in the final version of the thesis:

1. The author discussed only very limited materials used for the creation of advanced coating for the fibers. Can the reported approach be expanded for the other materials? Are there any limitations coming from the specific fiber structure which is different from planar surfaces?
2. Page 48: Figure 2-16 presents sketches for the section discussing 1D materials: I would suggest here to clarify a reader how 1D geometry is implemented. It can be done either by adding a new schematic or explaining this in the text.
3. Page 63: it should be clear from description of figure caption if the thickness is measured in air or water.
4. Page 66: please reformulate for clarity the following statement: “However, due to its small thickness (in the range of 3 nm), a smaller number of silica particles are adsorbed.”
5. Can the author say few words about the stability of the deposited coating?
6. What about the practical applications of the proposed fiber sensors?
7. Could the author add more comparative data between the designed sensors and the existing fiber-based solutions?
8. Please add description on what are the losses upon coupling into fibers.
9. Page 85: Figure 4-4: is this a schematic or microscopic image? This should be clear from Figure caption.
10. Page 119: it should be clear from Figure caption to Figure 7-1 from where experimental and theoretical data are taken.

Minor:

- Page 52: “.. the angle dependent diffraction or color ..” -> “wavelength” would be better here than “color”, although it is clear what is meant.
- Page 61: “10X states for the 10X Olympus objective..” -> “.. 10X denotes a 10X Olympus objective..”.
- Page 66: “..at their adsorption..” -> “.. is deposited to improve adsorption of silica particles”.
- Page 74: “further growth of silica nanoparticle size leads to”: I guess it is meant that adsorbing of nanoparticles of different (or larger) size, because particles do not seem to be growing on fibers.
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Overall assessment: the thesis represents in-depth characterization of LbL coated optical fibers. After correcting some minor points mentioned above, I recommend that Timur Ermatov should defend the thesis by means of a formal thesis defense.

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*