

REVIEW

of dissertation for the acquisition of:

educational and scientific degree " doctor "	X
scientific degree " Doctor of Science "	
	the true is indicated by the sign "X"

Author of the dissertation:

		Vencislav	Venelinov	Bakov	UCTM
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

Synthesis and photophysical investigation of novel fluorescence sensors based on 1,8-naphthalimide architectures

Scientific area:

5	Technical Sciences
code	name

Professional area:

5.10	Chemical Technology
code	name

Scientific specialty:

Technology of fine organic and biochemical synthesis

The review was written by:

Professor	PhD	Lian	Lyubenov	Nedelchev	IOMT – BAS
academic position	scientific degree	name	middle name	last name	workplace

1. Completion of the provided documents:

A) The dissertation and the competition documents are in full compliance with the Regulations.	4 points	X
B) The documents are complete but do not fully comply with the requirements of the Regulations.	2 points	
C) The documents are not completed in accordance with the requirements of the Regulations.	0 points	

		one of the answers given is marked with the sign "X"
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Missing documents and violated standards must be described if response C is marked.

2. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.
The dissertation of Assist. prof. Eng. Vencislav Bakov has a total of 136 pages and includes 141 literary sources. It was developed on the basis of three publications of the dissertation, which fully satisfy and even exceed the minimum requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for Acquiring Scientific Degrees and Holding Academic Positions at UCTM. Two of the publications are in the journals Photonics (WoS IF:2.4, Q2) and ChemistrySelect (WoS IF:2.1, Q3; Scopus: Q2), which are indexed in Web of Science and Scopus. The third article was published in a Proceedings of the XIX National Youth Scientific and Practical Conference 2022. In this article, V. Bakov is the first author. 9 citations of the dissertation publications have been found, which shows the relevance and high level of the research conducted.

3. The relevance of the topic of the dissertation:

A) The topic is relevant and new (there are no known results on the topic by other authors)	8 points	
B) The topic is relevant and results from other authors are known	6 points	X
C) The topic is not relevant, but results from other authors are known	2 points	
D) The topic is not relevant and no results from other authors are known	1 point	
E) The topic does not correspond to the level of dissertation	0 points	
		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the dissertation must be substantiated
The research in the dissertation is aimed at the synthesis and analysis of the photophysical properties of the fluorogenic derivatives of 1,8-naphthalimide. This choice of topic is based on the literature analysis, which shows that these chemical compounds have a number of advantages – bright fluorescence, large Stokes shifts and high chemical and photostability.

4. Knowledge of the problems, subject of research in the dissertation:

A) The doctoral student knows in detail the achievements of other authors on the topic of the dissertation	8 points	X
B) The doctoral student is partially familiar with the achieved results on the topic of the dissertation	4 points	
C) The doctoral student has no prior knowledge of the status of the problems in the dissertation	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

The Literature Review section of the dissertation is very well developed and richly illustrated, showing a thorough knowledge of the issues explored in the dissertation. 141 literature sources are cited, which also shows the detailed research of the field carried out by the PhD student.

5. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	X
C) Theoretical with application elements	4 points	
D) It does not correspond to the level of dissertation	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.

The PhD student has synthesized and characterized the photophysical behavior of a large number of new compounds derived from 1,8-naphthalimide. In many places in the dissertation, the possible application of the obtained new fluorophores as sensors is emphasized. For this reason, my opinion is that the research presented in the dissertation is applied.

6. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	3 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified.

The objectives of the research in the dissertation are determined based on the extensive literature research carried out, described in the literature review of the dissertation:

- Synthesis and investigation of 1,8-naphthalimide sensor architectures operating simultaneously via solid-state emission and photoinduced electron transfer.
- Synthesis and investigation of 1,8-naphthalimide sensor architectures operating simultaneously via solid-state emission and intramolecular charge transfer.
- Synthesis and investigation of new water-soluble 1,8-naphthalimide sensor architectures operating simultaneously via solid-state emission and intramolecular charge transfer.

The goals are realistic, which is evidenced by their successful implementation by the doctoral student and by the correspondence between the set goals and the achieved results. It should also be noted that the targets have a scientific-applied interest as they aim to solve some important challenges, such as the low water solubility of fluorophores.

7. Methods of research:

A) Adequate to research and set objectives	8 points	X
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	
C) Inappropriate methods	0 points	
		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.

In the dissertation, a wide range of methods are used and presented, which correspond to the set goals and the object of the research. These include, for example, the measurement of absorption spectra in the visible and ultraviolet regions, as well as in the infrared (in order to use FTIR spectroscopy). Fluorimetric methods were also applied to determine the fluorescence spectra of the samples. With the help of NMR spectroscopy, the chemical structures of the obtained compounds were confirmed. Thin-layer and preparative chromatography methods were also used.

8. Contributions of the dissertation:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	X
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
C) They are of scientific and / or applied interest	12 points	
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.

The contributions stated in the thesis are as follows:

- Sixteen 1,8-naphthalimide sensors operating on the basis of photoinduced electron transfer were synthesized and their chemosensory properties were first investigated in the solid state
- Two 1,8-naphthalimide sensors operating on the basis of intramolecular charge transfer were synthesized and their chemosensory properties and application in solid phase were investigated for the first time
- Three new water-soluble 1,8-naphthalimide sensors have been synthesized, operating simultaneously on the basis of solid-state emission and intramolecular charge transfer. Their chemosensory properties and application in both solution and solid state were investigated.

I believe that they highlight the most important results achieved in the dissertation, both from the point of view of the synthesis of fluorophores and from the point of view of the analysis of their photophysical properties.

9. Evaluation of the compliance of the dissertation summary with the dissertation:

A) Full compliance	4 points	X
B) Compliance of the main parts	2 points	
C) Lack of compliance of the main parts	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

The dissertation summary fully corresponds to the dissertation. The main results achieved, experimental methods, conclusions and scientific contributions are detailed and presented in a clear and understandable way.

10. Participation of the doctoral student in the achievement of the results of the dissertation:

A) The doctoral student has at least an equal participation	8 points	X
B) The doctoral student has secondary participation	5 points	
C) The participation of the doctoral student is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items B or C is marked.

The PhD student is the first author of one of the publications and the second author of the other two, which shows his active participation in achieving the results of the dissertation. Also, the Author Contributions section of the Photonics article shows that he was involved in both the investigation (synthesis and photochemical analysis) and the analysis of the results. This gives me reason to believe that he has at least an equal participation in the results reported in the dissertation.

11. Critical notes:

A) Lack of critical notes	8 points	X
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved	4 points	
D) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C or D is marked.

The dissertation is prepared at a high scientific level, and is also very well-formed and with a minimum number of technical errors. This is rare these days, and I can only congratulate eng. Bakov on his careful and precise work.

12. Conclusion

A) The evaluation of the dissertation is POSITIVE	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the dissertation is NEGATIVE	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

To be filled in at the request of the reviewer

The dissertation not only meets, but also exceeds the requirements of the Law for the acquisition of a PhD degree. The excellent presentation of the dissertation, as well as the extensive scientific research on which it is based, is also impressive. All this gives me reason to confidently give a positive evaluation of the dissertation of assist. prof. eng. Vencislav Bakov.

04.01.2024	The review was written by:	
date		signature