Appendix 12a

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:

Assistant		Dimitar	Krasimirov	Dimitrov	HTMU - Sofia
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

FUNCTIONAL THIN-FILM COATINGS WITH THE PARTICIPATION OF GRAPHENE

Scientific area:

5.	Technical sciences
code	name

Professional area:

5.10	Chemical technologies
code	name

Scientific specialty:

Technology of silicates, binders and refractory non-metallic materials

The review was written by:

Professor	PhD	Tsvetan	Ivanov	Dimitrov	Ruse University "Angel Kanchev"
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"

Missing documents and violated standards must be described if response C is marked.
The documents for the competition are drawn up in accordance with the regulations for acquisition of scientific degrees and acquiring academic positions of the University of Chemical Technology and Metallurgy

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.
According to the regulations for acquisition of scientific degrees and acquiring academic positions of the University of Chemical Technology and Metallurgy for obtaining the educational and scientific degree "Doctor" the minimum required points by groups of indicators are: dissertation work for awarding the educational and scientific degree "Doctor" - 50 points and 30 points as the sum of the points of indicators from 5 to 11. The candidate has submitted a dissertation work and 4 scientific publications reflecting the main results in it. All publications are in refereed and indexed editions (indicator 7) and with them the candidate collects a total of 43.71 points, which is above the required minimum. The presented research results are related to 4 scientific projects of HTMU, consulting activities on 3 diploma theses and have been reported at 12 conferences, 5 of which are international. 28 citations in scientific publications, referenced and indexed in world-renowned databases of scientific information, have been noted.

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 topic of obtaining functional thin-film coatings with the participation of graphene is extremely relevant, as it combines fundamental scientific research and practical applications with enormous potential. The development of research in this area can lead to significant technological solutions in electronics, medicine, energy and environmental protection.

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 doctoral student demonstrates detailed knowledge of the current state of research on the topic of his dissertation, which is very well presented in the detailed theoretical part and has contributed to conducting scientific research at a high level. This is evident from the fact that the dissertation reviewed and cited 120 literary sources, almost all in English and over 50% of them were published in the last 10 years.

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 research within the framework of this dissertation could be classified as fundamental with an applied focus. Modified synthesis methods have been developed, leading to the production of new or modified applied products and new theoretical knowledge about the relationship between technological parameters - product characteristics, which are extremely important for their application in electronics, medicine, energy, environmental protection and other areas.

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 research goals are realistic, well-founded and represent scientific and applied interest. They are related to the preparation and characterization of functional thin-film coatings with the participation of

graphene materials with subsequent possibilities for application in optics, such as protective and antibacterial coatings. Several tasks have been formulated, which include the preparation and characterization of new thin-film optical coatings according to predefined parameters, testing of various materials for inclusion in thin-film coatings, characterization of polymer composites with the participation of graphene materials, research and optimization of the method for processing the substrates, preparation of nanoparticles for inclusion in composites, application of appropriate methods for characterization of the obtained coatings, etc.

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 this dissertation work, original compositions of thin-film optical coatings were obtained using the Electron Beam Physical Vapor Deposition (EBPVD) method. A complete characterization of the newly synthesized thin-film optical coatings was performed using appropriate instrumental methods: X-ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Raman spectroscopy, Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), Determination of antimicrobial properties.

8. Contributions of the dissertation:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	**X**
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 main contributions of the dissertation are of a scientific and applied nature and give a clear idea of what is being done for the first time and what are the original solutions that the doctoral student and his supervisor offer. They are mainly reduced to the following: ➢ A new methodology for obtaining optical coatings with specified optical properties such as high transmittance and reflective properties using the electron beam physical vapor deposition method is proposed. ➢ A procedure for replacing Ti_3O_5 with ZrO_2 in the composition of multilayer optical coatings while maintaining optical properties is proposed and methods for compensating for the emerging differences in the optical behavior of the coatings are proposed.

➢ Original compositions of nanocomposites based on silicone rubber with the participation of RGO and nanosized ZnO in different ratios are obtained. The antimicrobial properties of different compositions are studied and the most active of them are determined. ➢ The properties of GO and GPL for association with nanosized $ZnTiO_3$ particles were compared and it was shown that in the presence of GPL the nanoparticles are more stable and resistant to aggregation. ➢ The influence of the viscosity of the polymer matrix on the delamination of the graphene layers and the stability of the suspension was evaluated.

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 content of the dissertation summary fully corresponds to the description of the experiments, the results obtained, the analyses and the conclusions presented in the dissertation. It fully and accurately reflects the main contributions of the dissertation.

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.
I believe that the doctoral student has an important contribution in conducting the experiments and presenting the results of the research that are included in the dissertation. In one of the publications, the doctoral student is in first place, and in another - in second place. All four publications are indexed in Scopus. Although all 4 publications are co-authored, I believe that this is evidence that the doctoral student has at least equal participation. No division protocol for the percentage distribution of contributions in the publications is presented, which implies equal participation of the co-authors.

11. Critical notes:

A) Lack of critical notes	8 points	
B) Critical notes of a technical nature	7 points	**X**
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.
According to the rules for developing a dissertation work, the aim of the dissertation work should be one, and the tasks from 4 to 6. In this case, the doctoral student has submitted 9 tasks. I consider it appropriate to combine some of the tasks and thus make the tasks 6; Some technical omissions have been noted in the text of the dissertation work and the abstract. ➢ The most comments are made regarding the presented list of literary sources in the dissertation work: there are many inaccuracies in the citation - incomplete citation in some places, a lot of information is missing, there are merged words without a space, when citing the literature, different citation styles are used - the year after the first author or at the end, in brackets or without brackets; the year of publication of some literary sources is not indicated [3, 69, 82,107]; the pages of many publications are not indicated [3, 17, 18, 19, 29, 30, 31, 32, 33, 37 and others]; it is not indicated where the article was published [3, 70, 87]; in some cases [56, 63, 64, 65, 84] the authors, the title of the article or the journal are written in capital letters; ➢ in Fig. 38 referring to the reflection curves of the experimentally obtained coatings in the dissertation work and in the abstract there is no information on the X and Y axes of the respective dependencies; ➢ The formulas used in the dissertation on p. 61 / in the text / and p. 86 are not numbered in order to facilitate comments and discussion; ➢ there is no two-sided alignment of the text at the end of the dissertation work - from p. 101 to p. 115.

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
Assist. Prof. Eng. Dimitar Krasimirov Dimitrov has collected an asset of 93 points, which exceeds the required minimum of 65 points. His dissertation work on the topic "Functional thin-film coatings with the participation of graphene" with scientific supervisor Prof. PhD. Eng. Anna Staneva contains modern and significant scientific and scientific-applied achievements and I highly appreciate the developed dissertation. I believe that the development and defense of Assist. Prof. Dimitar Dimitrov's dissertation will contribute to his future successful professional career and I support awarding him the educational and scientific degree "Doctor" in the professional field 5.10. Chemical technologies, scientific specialty Technology of silicates, binders and refractory non-metallic materials.

05.08.2025	The review was written by: Prof. PhD Tsvetan Ivanov Dimitrov	
date		signature