

REPORT

to occupy the academic position:

"Professor"	
"Associate Professor"	X
	one of the academic positions indicated shall be marked with the sign "X"

Candidates to occupy the position:

1	Senior Assist.-Prof.	Dr.	Emil	Ivanov	Lilov	UCTM-Sofia
No	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

4	Natural Sciences, Mathematics and Informatics
code	name

Professional area:

4.1	Physical Sciences
code	name

Scientific specialty:

Condensed Matter Physics

The competition has been announced:

34	11.04.2023	Department of Physics	Faculty of Chemical Technology
In SG issue	date	for the needs of the Department	Faculty

The report was written by:

Assoc. Prof.	Dr.	Ruzha	Georgieva	Harizanova	UCTM-Sofia
academic position	scientific degree	name	middle name	last name	workplace

1. Report for the candidate:

Senior Assist.-Prof.	Dr.	Emil	Ivanov	Lilov
academic position	scientific degree	name	middle name	last name

1.1. 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.

In the competition for the academic position "Associate Professor", Dr. Emil Lilov applies with 18 scientific works in total which are published in referred and indexed journals and books. 10 of the submitted articles substitute for the habilitation thesis (indicator 4 from the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and the Regulations for the application of LDASRB at the UCTM), the rest of them – 8 in total correspond to indicator 7. There are also 1 patent (indicator 24) and 1 utility model (indicator 25) submitted for the competition.

During the last 5 years, the candidate has taken part in 11 international and national conferences. He has 81 citations of his scientific works.

A list with the co-authored practical tuition manuals (1) – indicator 23 – has been submitted. A list is supplied with the participation in 13 and coordination of 8 - in total 21 scientific projects with the BNSF/ Bulgarian Ministry of Education and the Scientific sector of UCTM, according to indicators 14 and 16.

Dr. Lilov was appointed to deliver lectures in two courses and has co-authored the preparation of 2 teaching programs for the educational and qualification degree Bachelor, as well as he has supervised 2 Bachelor theses of students from the UCTM.

From the obligatory **400 points** for the occupation of the academic position "Associate Professor" in the professional direction 4.1 Physical sciences, according to the Regulations for the application of LDASRB at the UCTM, Dr. Lilov applies in the competition with materials, corresponding to **498 points**.

1.2. Relevance of scientific and / or applied research:

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other authors)	8 points	
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	6 points	x
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	4 points	
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	

		one of the answers given is marked with the sign "X"
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The evaluation of the relevance of the research must be substantiated.
<p>The areas of scientific interests of Dr. Lilov are of both fundamental and applied character and could be summarized as follows:</p> <ol style="list-style-type: none"> 1. Study of the anodic behavior of antimony and characterization of the resulting coatings. 2. Study of the anodic behavior of zinc and characterization of the obtained coatings. Utilization of anodic films on zinc as photocatalysts for the degradation of methyl orange. 3. Investigation and characterization of bulk and thin film samples of bismuth containing chalcogenides. 4. Structural analyses of lead-borate composites containing PbMoO₄ nanocrystals. 5. Photocatalytic degradation of azo dyes. 6. Study of the corrosion resistance of anodic alumina/cerium conversion coatings (Al₂O₃/CeCC). <p>The scientific works submitted for the competition by Dr. Lilov are undoubtedly up to date and contribute to the expanding of the variety of advanced oxide and chalcogenide glassy and glass-ceramic materials as well as of thin and bulk antimony- and zinc-based films and of alumina/cerium conversion coatings. They also complement the existing information, concerning the structure, physical properties and optical characteristics of the thin chalcogenide and azopolymer films which contributes to the elucidation of their potential applicability as optical recording and information storage media. There is gathered and complemented the already existing information concerning the structure, physical characteristics, optical and thermal properties as well as electrochemical characteristics of thin antimony, zinc, bismuth-based chalcogenide and azopolymer films which complements the information about their applicability as media for optical recording, information storage and media for thermoelectric applications. Valuable information concerning the kinetics of thin zinc and antimony film formation has been accumulated in case of varying initial synthesis conditions. Investigation of the structure and the main parameters of the obtained thin films and characterization of their anodic behaviour has been carried out. The structure, the main parameters of the obtained films and their anodizing behaviour have been characterized. Very high forming voltage values varying from 100 to 350 V, depending on the anodizing conditions, have been achieved and the existence of induction periods in the kinetic curves has been established.</p>

1.3. 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	4 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 in the research activities of Dr. Lilov are of both fundamental and applied importance and could be summarized within the frames of the different areas of his scientific interests, as follows:

1. Study of the anodic behavior of antimony and characterization of the resulting coatings.

The main objectives of the investigations carried out in this scientific area of interests could be summarized like this: analysis of the break-down phenomena during the galvanostatic anodizing of antimony in water solutions of sulfuric, boric, phosphorous and oxalic acids at a constant temperature and establishing of the relations which are obeyed by the break-down voltages; studying of the formation of anodic films with different thickness in oxalic acid obtained in galvanostatic, isothermal regime; establishing the phase composition of the obtained anodic films and investigation of the forming efficiency of the films as a function of the current density; investigation of the optical properties of the oxalic acid obtained antimony thin films and how these depend on the oxalic acid concentration; investigation of the anodization kinetics in case of water solutions of potassium phosphate for different current densities and how the film synthesis parameters and thickness influence the dielectric properties of the obtained material. (publications 4.1, 4.3, 4.6 and 4.9).

2. Study of the anodic behavior of zinc and characterization of the obtained coatings. Utilization of anodic films on zinc as photocatalysts for the degradation of methyl orange.

Main goal of this kind of investigations of the candidate is the study of the anodic behaviour of zinc in case of different thin film synthesis conditions in oxalic acid and sodium hydroxide solutions aiming to determine the kinetics of film growth, as well as studying the peculiarities of the phase formation and microstructure of the obtained materials. (publications 7.3, 7.6 and 7.7).

Next research objective, which as obtained results also belongs to this area of scientific interests, is to explore the possibilities for the application of thin anodic zinc films as photocatalysts for the degradation of methyl orange and to characterize their structure, phase composition, topography and optical properties by a number of modern and appropriately selected methods and techniques. (publication 4.7).

3. Investigation and characterization of bulk and thin film samples of bismuth containing chalcogenides.

Within the frame of this area of research interests of Dr. Lilov, the synthesis of bulk glass-crystalline/crystalline specimens in the system Bi-Se-Te for a varying ratio of the selenium and tellurium concentrations is aimed and their phase, structural and physico-chemical characterization is envisaged; obtaining of thin films from these materials and establishing of their main optical and thermoelectric characteristics and dielectric constants in dependence of temperature, the synthesis method – VTE or PLD and the composition. (publications 4.2, 4.4, 7.1, 7.2, 7.4, 7.5).

4. Structural analyses of lead-borate composites containing PbMoO₄ nanocrystals

In this research area the synthesis of composite materials consisting of a lead-borate glass matrix and PbMo₄ nanocrystals by using the incorporation technique as well as investigation of the structure of the obtained materials is aimed. (publication 4.5).

5. Photocatalytic degradation of azo dyes.

Here the main research goal is to find the dependence of the photodegradation velocity of the methyl orange dye in dependence of its initial concentration and to establish the photodegradation mechanism. (publication 4.8).

6. Study of the corrosion resistance of anodic alumina/cerium conversion coatings (Al₂O₃/CeCC).

The synthesis and the investigation of the corrosion resistance of compound anodic alumina/cerium conversion coatings (Al₂O₃/CeCC) as a function of the thermal treatment and the medium in which this treatment is performed is aimed. (publication 4.10).

1.4. Candidate research contributions:

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 scientific contributions in the candidate's research activities are of a significant fundamental and applied interest and can be summarized, according to the scientific areas, as follows:

1. Study of the anodic behavior of antimony and characterization of the resulting coatings.

The break-down phenomena in case of galvanostatic anodizing of antimony in water solutions of sulfuric, boric, phosphorous and oxalic acid at a constant temperature have been determined and the relations which are obeyed by the break-down voltages are established; the formation of anodic films with different thickness in oxalic acid obtained in galvanostatic, isothermal regime has been studied; the phase composition of the obtained anodic films has been established and the forming efficiency of the films as a function of the current density is determined; the optical properties of the oxalic acid obtained antimony thin films are studied and how these depend on the oxalic acid concentration; the anodization kinetics in case of water solutions of potassium phosphate for different current densities has been studied and it is determined how the film synthesis parameters and thickness influence the dielectric properties of the obtained material. (publications 4.1, 4.3, 4.6 and 4.9)

2. Study of the anodic behavior of zinc and characterization of the obtained coatings. Utilization of anodic films on zinc as photocatalysts for the degradation of methyl orange.

The main contributions of Dr. Lilov in this research area concern the investigation of the anodic behaviour of zinc in case of different synthesis conditions in oxalic acid and sodium hydroxide solutions and in establishing the kinetics of film growth, determining the peculiarities of the phase formation and the microstructure of the obtained materials. (publications 7.3, 7.6 and 7.7).

Another group of scientific contributions in the research activities within this area concerns the establishing of the possibilities to use the thin zinc oxide anodic films as photocatalysts for the degradation of methyl orange and the characterization of the structure, phase composition, topography and the optical properties by utilizing a number of modern and appropriately selected methods and techniques. (publication 4.7).

3. Investigation and characterization of bulk and thin film samples of bismuth containing chalcogenides.

Within the frames of this research area of Dr. Lilov, his contributions concern the preparation of bulk, glass-crystalline/crystalline specimens in the system Bi-Se-Te with varying ratio in the selenium and tellurium concentrations and their phase composition,

structural and physico-chemical characterization; synthesis of thin films from these bulk materials and establishing their main optical and thermoelectric characteristics, and determining of the dielectric constants in dependence of temperature, the preparation method (VTE or PLD) and the composition. (publications 4.2, 4.4, 7.1, 7.2, 7.4, 7.5).

4. Structural analyses of lead-borate composites containing PbMo₄ nanocrystals

In this scientific area the main contributions concern the synthesis of composite materials consisting of a lead-borate glass matrix and PbMo₄ nanocrystals by using the incorporation technique as well as investigation of the structure of the obtained materials. (publication 4.5).

5. Photocatalytic degradation of azo dyes.

Here the main contributions concern finding the dependence of the photodegradation velocity of the methyl orange dye on its initial concentration and establishing the photodegradation mechanism. (publication 4.8).

6. Study of the corrosion resistance of anodic alumina/cerium conversion coatings (Al₂O₃/CeCC).

The contributions of the candidate in this research area concern the synthesis and the investigation of the corrosion resistance of compound anodic alumina/cerium conversion coatings (Al₂O₃/CeCC) as a function of the thermal treatment and the medium in which this treatment is performed. (publication 4.10).

1.5. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	x
B) The candidate has at least an equal participation in most of the submitted papers	7 points	
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation 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 C or D is marked.

Dr. Emil Lilov applies in the competition for the occupation of the academic position "Associate Professor" for the needs of the Department of Physics at the UCTM with 18 scientific works in total, 10 of which substitute for the habilitation thesis (indicator 4) and the rest of the publications correspond to indicator 7, as well there are submitted two patents, according to the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and the Regulations for the application of LDASRB at the UCTM. The applicant's contribution to the publications submitted in the competition is undisputable and equal as participation which is supported by his leading or significant part in the preparation of most of the 18 papers - in 8 of them he is the first author and in 7 papers – the second one.

1.6 Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and	8 points	X
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useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.		
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	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 have no critical comments about the materials submitted by Senior Assist.-Prof. Dr. E. Lilov in the competition concerning his pedagogical activity. Dr. Lilov was appointed to deliver lectures in two courses (Physics and Solid State Physics) and has co-authored the preparation of 2 teaching programs for the educational and qualification degree Bachelor, as well as he has supervised 2 Bachelor theses of students from the UCTM.

1.7. 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 in a small part of the research	5 points	
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) 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, D or E is marked.
I have no critical comments/remarks regarding the documents submitted by Senior Assist.-Prof. Dr. Emil Lilov in the competition for the academic position "Associate Professor".

1.8. Conclusion

A) The evaluation of the candidate's activity is POSITIVE	This evaluation is assigned to a total number of at least 50 points	X 74 points in
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		total
B) The evaluation of the candidate's activity is NEGATIVE	This evaluation is assigned to a total number below 50 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the member of the scientific jury

The materials submitted in the competition allow me with conviction to give a positive evaluation of the research and pedagogical activities of the candidate because they correspond to and for some indicators exceed the minimum requirements determined in the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and the Regulations for the application of LDASRB at the UCTM.

Based on the stated above and due to my positive personal impressions of the candidate, I would recommend

Senior Assist.- Prof. Dr. Emil Ivanov Lilov

to be appointed at the academic position "Associate Professor" in the professional area 4.1. Physical sciences and scientific specialty „Condensed Matter Physics“ at the Department of Physics at UCTM.

07.08.2023	The report was written by:	
date		Signature