

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	Chief Assist. Prof.	PhD	Iliyan	Stoykov	Mitov	UCTM-Sofia
No	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	Technical sciences
code	Plastic deformation processing technologies, machines and systems

Professional area:

5.6	Materials and materials science
code	name

Scientific specialty:

Materials science and technology of engineering materials
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The competition has been announced:

64	05.08.2025	Physical Metallurgy and Thermal Aggregates	FMMS
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Professor	Doctor	Rozina	Mihaylova	Yordanova	UCTM, Sofia
academic position	scientific degree	name	middle name	last name	workplace

1. Report for the candidate:

Chief Assist. Prof.	PhD	Iliyan	Stoykov	Mitov
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.

The candidate in the competition, Chief Assistant Prof. Dr. Eng. Iliyan Mitov, satisfies and exceeds the minimum requirements for occupying the academic position "Associate Professor", regulated in the PPZRASRB and PPNSZAD at the UCTM, Sofia, in the scientific field 5. Technical Sciences.

The indicators of the candidate for the academic position "Associate Professor" at the UCTM, in the individual groups are as follows:

- Indicator 1 – PhD thesis "Research of transfer processes in rotary kilns" - **50 points**
- Indicator 4 - Habilitation work - 10 scientific publications in publications that are referenced and indexed in world-renowned databases with scientific information - **150 points**
- Indicator 7 - Scientific publication published in publications that are referenced and indexed in world-renowned databases with scientific information - 5 publications; **99 points**
- Indicator 8 - Scientific publication published in non-refereed journals with scientific review or in edited collective volumes - 12 publications; **108 points**

Total points from indicators 7 and 8 - 207 points, with a minimum required of 200 points

- Indicators from 12 to 15 (citations) - **630 points**, with a minimum required of 100 points
- In addition, Chief Assistant Prof. Dr. Eng. Iliyan Mitov has presented a published in co-authorship university textbook (Indicator 24), as a result of which he receives **10 points**.

The total number of points is 1047 with a minimum required of 400.

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"

The evaluation of the relevance of the research must be substantiated.

The presented works are grouped into four topical areas. The scientific works present theoretical and experimental results and analyses in the field of engineering materials science and metallurgy.

The first group of papers is related to improving the energy and environmental efficiency of modern metallurgical production, solving a number of thermal engineering problems through the application of optimization methods and numerical modeling.

The second group of papers is fundamental in nature, enriching knowledge about transport processes in rotary kilns.

Papers are presented in an extremely topical area, namely the utilization of waste from the metallurgical industry – group three. New methods and technological schemes have been developed for the utilization of various metallurgical wastes in a solid state, leading to positive economic and environmental effects.

The fourth group of works is devoted to the study of changes in the microstructure and wear resistance of metal materials as a result of various heat treatments, defect diagnostics, and the study of possibilities for obtaining new metal-based composite materials. The research is relevant and contributes to contemporary engineering requirements for high-quality metal products with high performance properties, reliability, and long service life.

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 set for the research are realistic and adequate. The objectives are achieved through the application of modern scientific methods for research and analysis, processing of experimental data, and use of modern software products for modeling and optimization of processes. The research presented in the scientific works of Assist. Prof. Dr. Mitov is scientific and applied in nature and is aimed at solving theoretical and practical problems in the field of metallurgy and metal materials.

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 research work of Assist. Prof. Dr. Mitov is related to the acquisition of new scientific and applied scientific knowledge in the field of engineering materials science and metallurgy, grouped in the following areas:

- Improving the energy and environmental efficiency of metallurgical units by solving various thermal engineering problems;
- Studying transport processes in rotary kilns;
- Utilization of waste from the metallurgical industry;
- Heat treatment of metal materials and investigation of their microstructure and wear resistance.

Scientific and applied scientific contributions have been made in each of these areas, the most important of which are:

- Based on mathematical models and optimization of technological processes, methods have been developed for the technological and thermal integration of flat steel product manufacturing, which allows hot charging of blocks and reduces reheating costs by up to 40%.
- Based on modeling and simulation using software products (ANSYS-Fluent, etc.) of the combustion and heat exchange processes in metallurgical furnaces, experimental and computational methods for sizing furnace chambers have been developed, applicable in real production conditions.
- Solutions have been proposed to reduce greenhouse gas emissions by optimizing the combustion process and introducing combined burners with alternative and secondary fuels
- Two unique test benches have been designed, manufactured, and put into operation: - a directly heated tubular rotary furnace designed to study the movement of dispersed particles and heat transfer; - an indirectly heated rotating drum, which can be used to determine the coefficient of contact heat transfer between the wall and the bulk layer. Proprietary methodologies and measuring instruments have been developed that allow experimental determination of thermal parameters under controlled changes in rotation speed, degree of filling, and physical and mechanical characteristics of the material (quartz sand, glass and copper spheres, etc.).
- Two original mathematical models have been developed – a model for the deviations of falling particles in a rotary kiln and the so-called "total model" for determining the total and active thickness of the layer. The models show good convergence between theoretical and experimental data.
- A systematic experimental analysis of the contact heat transfer between the wall and the layer of solid material in indirectly heated furnaces has been carried out. It has been shown that existing analytical models often give significantly different results and do not take into account the actual motion regimes. It has been proven that in rolling motion there is good agreement between models and experimental data. In cavitation and sliding motion, characteristic of a number of industrial installations, the measured coefficients are 3–5 times lower than predicted. These results are an original scientific contribution, as they change the perception of the reliability of classical models and provide a basis for their calibration against real conditions.
- A new technology for processing barite waste has been developed and implemented in industrial production, based on research into the calcination process of barite extracted from tailings storage facilities, with the aim of obtaining BaSO_4 with improved whiteness and determining the optimal conditions (temperature, residence time, particle size) at which a 4–20 unit increase in whiteness is achieved.
- The possibilities for processing iron-containing waste from metallurgical production by direct reduction have been investigated. The main parameters of the reduction (temperature, time, pressure, gas composition) were established. The experimental results obtained were applied in the construction of a plant for the direct reduction of iron-containing pellets.
- Three different technological schemes have been developed for extracting iron components from the tailings storage facility at Kremikovtsi Metallurgical Complex, which are incorporated in the construction of a flotation plant for barite and iron concentrate
- An innovative method for reducing copper waste by optimizing technological parameters (temperature, time, particle size) has been developed.
- The wear resistance of M390P powder steel (1.9% C, 20% Cr, 4% V, etc.) and various high-chromium cast irons after different heat treatment regimes has been established. Quantitative

relationships between temperature, heat treatment regime, hardness, and wear resistance parameters have been established. Optimal heat treatment regimes have been determined, ensuring a balanced combination of hardness and wear resistance for specific operating conditions.
Based on metallographic studies and diagnostics of defects in sheet metal for tin cans, in pistons and barrels for air guns, and in cylinder-piston groups of machines, a direct relationship has been established between metallurgical homogeneity, technological production parameters, and operational reliability. Practical guidelines for controlling production parameters (heat treatment, machine settings, lubrication, and maintenance) have been proposed, which can extend the operational life of parts and equipment. Criteria for early diagnosis and incoming inspection of materials have been developed.

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	
B) The candidate has at least an equal participation in most of the submitted papers	7 points	X
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.

1.6. Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.	8 points	X
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.

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.

1.8. Conclusion

A) The evaluation of the candidate's activity is POSITIVE	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the candidate's activity 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 if requested by the reviewer

The candidate has fulfilled the minimum requirements of the Law on RASRB, PNSZAD and PPNSZAD of HTMU for holding the academic position of "Associate Professor". Based on the analysis of the publications and the results achieved, I give a positive assessment of the candidate's scientific research and pedagogical activity and I would like to propose to the esteemed scientific jury to accept and positively evaluate the candidacy of Chief Assistant Professor Dr. Eng. Iliyan Mitov for the academic position of "Associate Professor" in the scientific field of "Materials Science and Technology of Mechanical Engineering Materials", professional direction 5.6. Materials and Materials Science, field of higher education 5. Technical Sciences.

20.11.2025	The review was written by:	
data	Prof. Dr. Eng. Rozina Mihaylova Yordanova	signature