REVIEW

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of the materials submitted for participation in the competition
to occupy an academic position "**Associate Professor**" in:
area of higher education: **5. Technical Sciences**
professional field: **5.6. Materials and Materials Science**
specialty: **“Materials Science and Technology of Machine-Building Materials”**

In the competition for an associate professor, announced in the State Gazette, no. 54 of 25.06.2024 and on the TU-Gabrovo website Vladimir Petrov Todorov participates as the only candidate.

1. Short CV data

Vladimir Petrov Todorov was born in 1981. In 2000, he graduated from the High Technical School of Mechanical and Electrical Engineering in Vratsa, majoring in Radio and Television Technology. In 2004, he graduated from the "Materials Science and Materials Technology" (Bachelor's degree) at the Technical University - Gabrovo, and in 2006 he obtained a Master's degree in the same specialty. In 2016, he defended a PhD thesis on the topic "Influence of the carbide phase on the mechanical and operational characteristics of bainite cast irons" and obtained a PhD degree in the scientific specialty "Materials science and technology of engineering materials". In the period 2007-2014, Eng. Vl. Todorov works as a technologist in the Metalic BISIPI Company in Gabene, where he deals with lost wax casting technology. From 2016 to 2024, he was successively an assistant and chief assistant in the departments of "Mechanical Engineering and Technologies" and "Materials Science and Mechanics of Materials" at TU-Gabrovo. The candidate has a basic level of English and high-level skills of various software products – SolidWorks, Kompas - 3D, Autodesk Inventor, etc.

2. General description of the presented materials

All necessary materials are presented on electronic media. They are in full compliance with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Rules for its Application and the Rules for the Acquisition of Academic Degrees and the Occupancy of Academic Positions (RAADOAP) at TU-Gabrovo. The candidate has also submitted additional lists of participation in projects, printed textbooks, prepared and delivered lectures on certain disciplines,

According to the report presented, Head Assistant Vladimir Petrov Todorov, PhD, Eng., meets and in any cases exceeds the national requirements and those of TU-Gabrovo for the employment of AP "Associate Professor".

2.1. Requirements of LDASRB

- Indicator A – 50 points out of the required 50 points for a dissertation work for awarding PhD degree;

- Indicator B3 – 100 points out of the required 100 points for habilitation thesis – monograph;
- Indicator G – 213.51 points out of the required 200 points, which are subdivided as follows:
  - 31,05 points for G7 - scientific publication in journals that are referenced and indexed in world-renowned databases with scientific information and
  - 182,46 points for G8 - scientific publication in non-refereed journals with scientific review or in edited collective volumes.
- Indicator D - 420 points out of the required 100 points, including:
  - 420 points for D12 - citations or reviews in scientific publications, referenced and indexed in world-famous databases with scientific information or in monographs and collective volumes.

2.2. Requirements of TU-Gabrovo

- 25 articles presented, of which 4 individual and 6 with IF (WOS) in necessary 20 (4 individual and 1 with IF (WOS));
- Presented 42 citations at 5 required;
- Presented 2 published textbooks with 2 on demand;

3. Overview of the content and results in the presented works

3.1. Indicator B 3 – habilitation thesis – monograph

The candidate submits a **monograph "Improvement of mechanical properties and service behavior of iron-aluminum bronze with β-transformation".** It consists of 116 pages, including table of contents, 2 reviews, accepted abbreviations, introduction, 4 chapters, conclusion and 80 references. **The topic of the monograph does not repeat the topic of the PhD thesis**. The presented work is richly illustrated with the necessary figures, graphs and tables. In the monograph, an in-depth study of the microstructure, properties and operational characteristics of iron-aluminum bronzes with β-transformation is made. This work represents a fully completed scientific development with a practical-applied orientation, in which optimal modes of heat treatment (HT) and HT/SPD are proposed to obtain different combinations of operational characteristics. They are based on the results of conducted experiments, processed using mathematical modeling and verified by experiment. The scientific-applied contributions in the monograph can be defined as establishing new facts regarding: 1) the microstructures of the investigated bronzes and their transformations depending on the parameters of the applied treatments – thermal or a combination of HT/SPD; 2) the changes in static tensile strength, yield strength, plasticity, hardness, impact toughness, fatigue strength, friction and wear resistance depending on the time and temperature of HT; 3) complex evaluation of the effectiveness of the heat treatment on the investigated bronzes.

The monograph can be successfully used not only for training students in technical universities, by specialists in the field of material science and technology, but also by engineers in manufacturing enterprises.

3.2. *Indicator G7 - scientific publication in journals that are referenced and indexed in world-renowned databases with scientific information*

This section presents 6 articles with a **total impact factor of 9.053, published in journals with quartiles Q2 - 1 article, Q3 - 1 paper**. Three of the papers are published in journals of MDPI - "Metals", "Proceses" и "Materials", 1 - in Bulgarian Chemical Communications and 2 - in Journal of Physics: Conference Series.

In 4 of the presented articles (7.1, 7.2, 7.3 and 7.6), the structure and mechanical properties of welded joints of dissimilar alloys (titanium, aluminum, copper or stainless steel) made by electron beam welding were investigated. In article 7.4., the effect of heat treatment and intensive surface

plastic deformation on the mechanical characteristics of bronzes was investigated, and article 7.5. deals with the photopolymerization process of dental composites.

3.3. Indicator G8 - scientific publication in non-refereed journals with scientific review or in edited collective volumes.

Nineteen papers are presented, that have been published in the „Journal of Technical University Gabrovo“ – 3 and the proceedings of conferences in Bulgaria – 13 and Serbia – 3 articles.

They studied: the influence of the initial structure and heat treatment on the microstructure and mechanical characteristics of alloyed steels and aluminum bronze (8.1-8.3; 8.6; 8.15); the structure and mechanical properties of welding joints between copper and aluminum alloy made with an electron beam (8,5); the structure, mechanical characteristics, wear resistance and fatigue strength of ductile irons (8.4 and 8.7; 8.9-8.14; 8.16-8.19). Article 8.8 discusses the purpose of bottle deadheads in the casting process.

The content of the publications under indicators G7 and G8 refers to the development of new methodologies, the study of the microstructure and properties of a wide range of metals and alloys used in various branches of industry - copper and its alloys; aluminum alloys; alloyed and stainless steels, which is in full compliance with the direction and specialty of the competition. A total impact factor in this group of the order of 9.053 is proof of the high scientific and applied value of the researched problems and the obtained results.

4. Reflection of the candidate's scientific publications in the scientific field

In this section, the candidate presents 42 citations of scientific works, 36 of which are in journals with an impact factor. A Google Scholar review shows that Dr. Eng. Vladimir Todorov has 11 publications, 91 citations, and an H-index of 3. Scopus data is as follows: 7 publications, 64 citations, and an H-index of 3. No profile data in Web of Science. **This indicates relatively good visibility of the results.**

5. Contributions

In the submitted report, the candidate claims 18 scientific-applied and 9 applied contributions in 5 thematic areas. When compiling the contributions, it should be taken into account that they are a synthesis of the conclusions to the publications, and the conclusions are a synthesis of the results obtained from the research. Therefore, the result is the contribution itself, not the process of research, establishment, proof, unless a new research methodology is developed. In addition, the technological parameters and properties are more related to the applied contributions, and microstructure, mechanical properties, etc. – to the scientific-applied. It is in the light of these statements that my assessment of the candidate's contributions is made.

5.1. *Scientific-applied contributions*

I do not accept scientific-applied contributions as formulated by the applicant. They are mainly in the category "Obtaining and proving new facts" and in any scientific direction, they can be grouped as follows:

1. New facts have been established regarding the microstructure and mechanical characteristics of iron-aluminum bronze with β-transformation depending on the parameters of the applied treatments – HT or a combination of HT/SPD, and a complex evaluation of the effectiveness of the heat treatment on the investigated bronzes has been made.
2. New data on the microstructure and mechanical properties of welding joints made of dissimilar alloys (titanium, aluminum, copper and austenitic stainless steel) have been

established, as well as the influence of process parameters on them during electron beam welding.

3. New facts about the hardness of dental composites after photopolymerization with different parameters (light intensity, irradiation time and layer thickness) were obtained and optimization of the process was made to obtain maximum hardness.
4. New data on the microstructure and wear resistance of spheroidal cast irons, as well as the influence of alloying elements (Mo, S) and the amount of carbide phase on them, were established.
5. New facts about the microstructure and mechanical properties of medium-carbon low-alloy steels after various types of heat treatment were obtained.

5.2. *Applied contributions* – I accept the as defined contributions.

The critical analysis made shows that there is a sufficient number of original scientific-applied and applied contributions. All of them refer to established microstructure, mechanical and operational properties of a wide range of engineering materials - aluminum alloys, bronzes, steels and cast irons processed by electron beam, conventional heat treatment and surface plastic deformation methods. The developed optimal technological parameters of the production processes are of great practical application.

6. General description of the applicant's activity

6.1. Educational and pedagogical activity

It is clear from the attached references that head assistant professor Dr Vladimir Todorov gives lectures in 6 disciplines: Materials Science, Materials Science and Technology of Machine-Building Materials, Casting of Materials, Heat Treatment of Metals, Resource-Saving Technologies in Metal-working, Materials Technology and Materials Science. He conducts laboratory classes in 7 disciplines (the above + Non-metallic materials). The training includes full-time and part-time bachelor's and master's students from the following specialties: Electricity supply and electrical equipment; Materials technology and materials science; Computer technology in mechanical engineering; Mechatronics; Industrial heat and gas systems; Computer-aided design; Design, technique and technologies in textiles. The total workload of the applicant according to the references for the last 3 academic years is as follows: 851.3 hours for 2021/2022, 1066.8 for 2022/2023 and 1038.4 for 2023/2024.

For the period 2021-2024, under the guidance of head assistant professor Dr Vladimir Todorov diploma theses were developed and defended by 18 Bachelor degree students and 4 Master degree students.

The candidate submits 2 textbooks for the competition and thus covers the requirements of TU-Gabrovo:

• Maksimov J., Vl. Dunchev, Vl. Todorov. Metal Science and Heat Treatment Part I Metal Science. Publishing house V. Aprilov. Gabrovo. 2024. ISBN 978-954-683-696-0

• Maksimov J., A. Anchev, Vl. Todorov. Metal Science and heat treatment Part II Heat treatment of metals. Publishing house V. Aprilov. Gabrovo. 2022. ISBN 978-954-683-664-9

I highly evaluate both textbooks. They very clearly, accurately and consistently define the main concepts of metal science and the various types of thermal processing. The technological processes of heat and chemical-thermal treatment of steels, cast irons, non-ferrous metals and alloys are presented. The information in the textbooks is very well illustrated with photos and graphics. **With the synthesized information and the additional data on the materials, the textbooks can serve not only in training of the students at TU-Gabrovo, but also the specialists in the industry.**

6.2. Scientific and scientific-applied activity

The candidate has taken part in 10 university and 6 national projects - 1 under the National Research Fund, 4 - financed under "Operational programs", and 1 - from the "National Innovation Fund". It is important to note that the topics of all projects are in accordance with the scientific specialty of the competition. I highly evaluate the candidate's work on the national

project KP-06-H47/6-26.11.2020. (FNI) "Investigation of processes and structural changes during electron beam welding of metals and alloys with different thermophysical properties".

7. Evaluation of the candidate's personal contribution

In the presented scientific publications head asst. Vl. Todorov is an independent author of 4 publications, first author of 2 papers, second in 3 articles, third in 8 publications and subsequent author - in 9. It is noteworthy that the articles in which he is the leading author were published mostly in Bulgaria. **The candidate is a member of the author team (3rd place) of the two textbooks on "Metal science and heat treatment".** It is not possible to accurately assess the participation of the candidate, because they do not mention the share participation of each author, which is the rule for scientific works published by a collective of authors.

The participation of head asst. Vl. Todorov in more than half of the articles as a sole and first-third author, the participation in many university projects and 6 national, as well as the successful management of graduates show his active role in conducting research and teaching students.

8. Critical remarks and recommendations

Taking into account the intensive research work and academic load, the candidate has weak publication activity in prestigious international journals (3 articles with an impact factor from WoS and 3 articles in Scopus) and only one participation in a conference abroad – Serbia. Most of the publications were published in journals in Bulgaria or in proceedings of conferences organized by TU-Gabrovo, Plovdiv or STU of Mechanical Engineering.

In this regard, my recommendations are as follows:

• In the future head asst. Vl. Todorov to promote the results of his scientific activity at international conferences abroad and in prestigious international journals.

• Expand his participation and profiles in scientific networks such as the Web of Science to have greater visibility in the scientific community.

• When participating in such high-rank procedures, the conclusions to the individual articles, grouped by individual topics, should not be automatically given as contributions. It is necessary to summarize and synthesize the essence of the obtained results of the conclusions.

9. Personal impressions

I know head assistant Dr Vladimir Todorov for five years. He impressed me with his responsiveness, organization, accuracy in measurements and experiments, along with strict execution of the assigned tasks.

CONCLUSION

Based on the above, I propose that **Head Assistant Professor Vladimir Petrov Todorov**, Ph.D., Eng., **be elected as "Associate Professor"** in the area of higher education **5. Technical Sciences**, professional field: **5.6. Materials and Materials Science,** specialty: **"Materials Science and Technology of Machine-Building Materials"**

05 November 2024 **Reviewer**: ...../signature/.....
Varna (Prof. Tsanka Dikova, DSc)