

## OPINION

**of the materials submitted for participation in the competition for occupying the academic position "Associate Professor" in field of higher education – 5. Technical Sciences, professional direction - 5.6. Materials and Materials Science, specialty - "Materials Science and Materials Technology"**

**Member of the Scientific Jury: Prof. Galya Velikova Dancheva, DSc, PhD**

In the competition for occupying the academic position Associate Professor, announced in the State Gazette, no. 54/25.06.2024 and on the Technical University of Gabrovo website for the needs of the Department of "Material science and Mechanics of materials" at the Faculty of "Mechanical and Precision Engineering", as the only candidate participated Ch. Assistant Vladimir Petrov Todorov, PhD – Technical University of Gabrovo.

### **1. Overview of the content and results in the presented scientific works**

The candidate is a "doctor" in the scientific specialty "Materials Science and Materials Technology". Outside the scientific publications on the PhD dissertation, Ch. Assistant Vladimir Todorov participated in the competition with a total of 29 scientific works. The scientific works presented in the list for participation in the competition are entirely in the field of materials science and materials technology. The scientific works are distributed in groups of indicators according to ZRASRB/2019, as follows:

▶ ***Group A, indicator 1:*** Dissertation abstract for the award of "PhD" educational and scientific degree on the topic "Influence of the carbide phase on the mechanical and operational characteristics of bainitic cast irons" (2016) (A.1);

▶ ***Group B, indicator 3:*** 1 pc. published scientific work, presented by the candidate as a habilitation work – monograph on the topic "Improvement of mechanical properties and operational behavior of  $\beta$ -transformation iron-aluminum bronze", ISBN: 978-954-683-699-1 (2024) (B.3);

▶ ***Group G***

■ ***Indicator 7:*** A total of 6 scientific articles published in indexed editions of WoS and Scopus, distributed according to the place of publication as follows:

● 3 articles in international scientific journals with Impact Factor (WoS): Metals, MDPI (IF2023=2.9) (7.2); Material, MDPI (IF2022=3.4) (7.4); Processes, MDPI (IF2021=2.753) (7.5);

● 3 articles in international scientific journals with SJR (Scopus): Journal of Physics: Conference Series, respectively (SJR2023=0.18) (7.1) and (SJR2022=0.183) (7.3); Bulgarian Chemical Communications, Blagoevgrad, Bulgaria (SJR2022=0.168) (7.6);

■ ***Indicator 8:*** A total of 19 scientific publications, including 7 articles and 12 reports, distributed according to the place of publication as follows:

● 3 scientific articles in the Journal of the Technical University of Gabrovo: 2024 (8.1); 2023 (8.5); 2022 (8.6);

● 1 article in the International journal for science, techniques and innovations for the industry, edition of the Scientific and Technical Union of Mechanical Engineering "INDUSTRY 4.0", 2017 (8.7);

- 3 articles in Machines, Technologies, Materials. International virtual journal, edition of the Scientific and Technical Union of Mechanical Engineering: 2008 (8.9); 2010 (8.15); 2009 (8.16);
  - 3 reports at the 8th International Conference "Research and Development in Mechanical Industry" RaDMI: 2008 (8.13; 8.14); 2009 (8.18);
  - 2 reports at the International Scientific Conference "Mechatronics, eco- and energy-saving systems and technologies", Plovdiv, 2023 (8.2; 8.3);
  - 5 reports at the UNITECH International Scientific Conference, Gabrovo: 2023 (8.4); 2013 (8.8); 2011 (8.11); 2010 (8.12; 8.17);
  - 2 reports at the AMTECH International Scientific Conference, Gabrovo, 2007 (8.10; 8.19).
- ▶ 2 co-authored textbooks as follows: "Material Science and Heat Treatment. Part I: Material Science", 2024 and "Material Science and Heat Treatment. Part II: Heat Treatment of Metals", 2022;

Out of a total of 25 scientific articles and reports, 13 were published in English. Ch. Assistant Vladimir P. Todorov, PhD, is the sole author of 5 scientific papers, including the scientific work presented as a monograph. The candidate is first author in 2 scientific articles, second author in 3 scientific reports and third author in 9 scientific works, incl. both textbooks. *In numerical terms, the asset of the candidate according to group G indicators corresponds to 213.51 points.*

▶ **Group D**

The presented list of citations of scientific works includes a total of 42 citations in journals with Impact Factor. Of these, 39 citations are of scientific work 7.5. *As a result, the asset of the candidate under group D is equivalent to 420 points, which many times exceeds the minimum requirements.*

*The above confirms that the candidate's assets in quantitative terms satisfy the minimum national requirements according to ZRASRB/2019 and those of TU - Gabrovo for occupying the academic position "Associate Professor" in the field of the competition.*

## **2. General characteristics of the candidate's activity**

### **2.1. Educational and pedagogical activity**

Ch. Assistant Vladimir P. Todorov, PhD, led lectures in 6 disciplines: "Materials Science", "Materials science and Engineering Materials Technology", "Casting Materials", "Heat Treatment of Metals", "Resource-Saving Technologies in Material Processing" and "Materials Technology and Materials Science". The candidate led laboratory exercises in the same disciplines, as well as in the discipline "Non-metallic materials".

The candidate is the co-author of two textbooks, respectively the first and second part of the series "Metal Science and Heat Treatment", developed in the Department of "Material Science and Mechanics of Materials". Ch. Assistant Vladimir Todorov, PhD, has made a significant contribution to the maintenance and modernization of the material and technical base related to scientific research and the educational process in the field of the competition. He has developed a bench for the study of accelerated wear in the dry friction mode.

*The above facts confirm that the candidate has the necessary pedagogical training and qualification to occupy the academic position of "Associate Professor" in the field of the competition.*

### **2.2. Scientific and scientific-applied activity**

In the context of ZRAS/2019 and the specifics of the competition, the scientific work presented for the habilitation thesis – monograph (2024) has a determining importance. The

habilitation work (B.3) presents the results from theoretical and experimental research on the possibilities of various heat treatments and combined processes based on heat treatments and surface cold working, implemented in sliding friction contact, to improve the mechanical characteristics and operational behavior of two types of iron-aluminum bronzes with  $\beta$ -transformation: Cu-10Al-5Fe and cast Cu-11Al-6Fe (B.3). The structure, content, research methods and contributions of the presented work fully correspond to the required scientific level for a scientific monograph in the field of technical sciences.

In terms of topical subject matter and scientific level, the scientific papers for participation in the competition significantly build on and expand those on the PhD dissertation. The candidate's publications are oriented in the following thematic areas: 1). Improvement of the mechanical characteristics and operational behavior of iron-aluminum bronze with  $\beta$ -transformation (B.3; G.7.4; G.8.3). 2). Influence of the electron beam welding process parameters on the structure and properties of welded dissimilar metals and alloys (G.7.1; G.7.2; G.7.3; G.7.6; G.8.5); 3). Examination of dental composites subjected to photopolymerization (G.7.5); 4). Study of the structure, mechanical characteristics, and wear resistance of carbide-bainite ductile irons (G.8.4; G.8.7; G.8.9; G.8.10; G.8.11; G.8.12; D.8.17); 5). Improvement of the mechanical characteristics and operational behavior of medium-carbon low-alloy steels via heat treatment processes (G.8.1; G.8.6).

The fact that the scientific works with the participation of the candidate were cited in rated journals with Impact Factor proves that they are in the possession of the world scientific community in the field of materials science and engineering materials technology.

Ch. Assistant Vladimir Todorov, PhD, has participated in 6 national research projects, financed by the National Research Fund, four of which are in the field of the indicated thematic directions, and two with an educational focus, resp. under the operational program "Development of human resources". The candidate has participated as a researcher in a total of 10 university research projects - all in the field of the competition.

### **2.3. Implementation activity**

Two of the national research projects, financed by the National Research Fund, are related to the innovative implementation of spheroidal cast iron with a bainite and carbide-bainite structure, and one of them is aimed at the development of a production innovation – a technology for the production of complex high-strength cast iron castings.

## **3. Contributions and their significance for science and practice**

In general, I accept the classification and wording of the scientific-applied and applied contributions presented in the author reference. Undoubtedly, the contributions are significant and useful for science and practice. I will focus on the main scientific-applied ones, which are in the categories:

### **A. Creation of new classifications, methods, approaches, algorithms, constructions, models**

- *Different heat treatment processes and surface cold working and a combination of them with proven effectiveness for improving the mechanical characteristics and operational behavior of iron-aluminum bronzes with  $\beta$ -transformation obtained by hot plastic deformation and by the centrifugal casting method (B.3);*

- *Welded joints of dissimilar metals and alloys obtained by electron beam welding with different parameters (G.7.1; G.7.2; G.7.3; G.7.6; G.8.5);*

- *Regression models of the wear resistance in dry friction mode of carbide-bainite ductile irons, tempered in the temperature range of upper bainite – 400° C and lower bainite – 300° C (G.8.7; G.8.12; G.8.17).*

### **B. Obtaining and Proving New Facts**

- *The effects of various heat treatments and surface cold working on Surface integrity, mechanical characteristics, and tribological behavior in dry friction mode of iron-aluminum bronze Cu-10Al-5Fe have been proven (B.3; G.7.4);*
- *The influence of the temperature and the holding time during tempering on the mechanical characteristics of iron-aluminum bronze with  $\beta$ -transformation obtained by the centrifugal casting method was established (B.3; G.8.2);*
- *The influence of the tempering temperature on the microstructure evolution of iron-aluminum bronze with  $\beta$ -transformation, obtained by the centrifugal casting method was established (B.3; G.8.3);*
- *Results obtained from optimization procedures ensuring: 1) maximum plasticity; 2) maximum impact toughness; 3) high hardness and static strength; 4) high hardness, static and dynamic strength of iron-aluminum bronze with  $\beta$ -transformation obtained by the centrifugal casting method (B.3);*
- *The microstructure and mechanical properties of welded samples of dissimilar metals and alloys obtained by electron-beam welding with different parameters were determined (G.7.1; G.7.2; G.7.3; G.7.6; G.8.5);*
- *The influence of the photopolymerization process parameters on the obtained hardness of samples made of three types of dental composites was established (G.7.5);*
- *Optimal values of the photopolymerization process parameters were obtained, maximizing the hardness of three types of dental composites (G.7.5);*
- *The influence of the carbide phase amount on the structure and mechanical properties of bainite spheroidal cast irons was established (G.8.9; G.8.11);*
- *The influence of the carbide phase amount on the wear resistance in the dry friction mode of carbide-bainite cast iron, isothermally tempered in the temperature range of upper bainite – 400° C and lower bainite – 300° C (G.8.12; G.8.17);*
- *The influence of the Mo and Sn alloying elements on the structure and mechanical properties of cast iron with spheroidal graphite intended for isothermal hardening has been determined (G.8.4; G.8.10);*
- *The microstructure and mechanical properties of 42CrMo4 steel samples subjected to normalization and a combination of normalization, hardening and high-temperature annealing were determined (G.8.1);*
- *The evolution of the microstructure and mechanical characteristics of 35CrMnSi steel samples subjected to annealing and normalization were established (G.8.6).*

### **4. Evaluation of the candidate's personal contribution**

I believe that Ch. Assistant Vladimir P. Todorov, PhD, has made a significant contribution to the organization and conduct of scientific research in an applied aspect, as well as to the maintenance and modernization of the material and technical base in the department.

### **5. Notes and recommendations**

I would recommend Ch. Assistant Vladimir P. Todorov, PhD, to continue working at the accelerated pace he has been working with in recent years.

## **6. Personal impressions**

Ch. Assistant Vladimir P. Todorov, PhD, shows very good organization and fulfills the assigned tasks responsibly, qualitatively and on time.

## **7. Conclusion**

**Bearing in mind the above, I propose Ch. Assistant Vladimir Petrov Todorov, PhD, to be elected as an "Associate Professor" at the Technical University of Gabrovo in field of higher education - 5. Technical sciences, professional direction – 5.6. Materials and Materials Science, specialty – Materials Science and Materials Technology.**

**18.10.2024**

**Member of the Scientific Jury: /signature/  
/Prof. Galya V. Duncheva, DSc, PhD/**