

REVIEW

by competition for the occupation of the academic position “Associate Professor” in a scientific area 5. “**Technical Sciences**”, professional direction 5.1. “**Mechanical Engineering**”, in the scientific specialty “**Materials Science and Technology**”

announced in SG issue 2/05.01.2024,

with candidate: **Assist. Prof. Eng. Daniela Todorova Spasova, Ph.D.;**

reviewer: **Prof. Eng. Rayko Danailov Stanev, Ph.D.**

REASON for preparing the review: Order No. 108/28.02.2024 of the Rector of the Technical University – Varna for appointment of a scientific jury and decision of the scientific jury, reflected in the Protocol of its first meeting, held on 15.03.2024.

1. General and biographical data

Daniela Todorova Spasova was born on 25.01.1975 in Razgrad. She completed her secondary education in 1993 at the PMG “Acad. Nikola Obreshkov” – Razgrad. In the same year, she continued her studies at the Technical University – Varna, graduating in 1998 as a master’s degree in Mechanical engineering, majoring in “Materials Technology and Metalworking Technology”, with a higher education diploma No. 21601, issued on 15.10.1998.

In 2002, Mrs. Spasova began her doctoral studies in the scientific specialty “Materials Science and Technology of Machine-Building Materials” with code 02.01.02. Defends a dissertation on the topic “Obtaining of Complex-Relief Cast Composites by Using the Capillary Molding Method”, with diploma No. ТУВ-НС-2017-089, issued on 02.06.2017.

From 2009 to the present, Eng. Daniela Spasova is a teacher in the Department of “Materials Science and Technology” at the Faculty of Manufacturing Engineering and Technologies of the Technical University – Varna, currently holding the academic position “Assistant Professor”.

Assist. Prof. Eng. Daniela Todorova Spasova, Ph.D. was admitted to participate in the competition by a commission appointed by order No. 117/03.06.2024 of the Rector of TU – Varna, according to protocol No. 16/07.03.2024 of the commission’s work.

2. General description of the presented materials

The candidate is submitted for review a total of 30 scientific works, divided into two main groups, as follows:

- 10 are in editions that are referenced and indexed in world-renowned databases with scientific information and are united as equivalent to a monographic thesis (indicator 3.4.);
- 20 are publications that do not fall into the previous category, of which 1 is in an edition that is referenced and indexed in world-famous databases with scientific information (indicator 4.7.), and the remaining 19 – in non-refereed journals with scientific review or in edited collective volumes (indicator 4.8.).

In 7 of the 10 publications, which are equivalent to a monographic thesis, the candidate is the first author, as 2 of them are his independent works, and in the other 3 his name is in the fourth position.

The distribution of the remaining publications, which were not included in the competition as a habilitation thesis, is as follows: in the only one article printed in an edition, referenced and indexed in world-famous databases with scientific information, Ms. Spasova is the third author, and among the works in non-refereed peer-reviewed journals or in edited collective volumes, her name is first in 13 of them, second one – in 1 publication, third – in three and fourth – in 2 of the presented scientific papers.

As expected, all works from the first main group are in English. From the second one, there are 2 publications in Bulgarian, and the remaining 17 papers are also in English. Attached is a list of 10 research projects, one of which was carried out under the leadership of Assist. Prof. Daniela Todorova Spasova, and in the others she is a member of the developing team.

All submitted scientific works are accepted for review, because they are related to the issues of the competition and do not repeat the 6 publications included at the acquisition of the educational and scientific degree “Doctor”. For each article, evidence or declarations are attached for its authenticity, general availability on paper and electronic media, as well as for the reliability of the information contained in it.

The balance sheet shows that Assist. Prof. Spasova is the lead author in the majority of the reviewed works, and also that she has made efforts to make her research accessible to a wide range of scientists and specialists thanks to their description in English, which should lead to a higher future citation of the candidate’s papers.

As a conclusion to this section, it can be summarized that it is present a fulfillment and exceeding (by two of the indicators it is double) of minimum national requirements for the acquisition of the academic position “Associate Professor” according to the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its application and the Regulations for the terms and conditions for occupying academic positions at the Technical University – Varna.

3. General characterization of the candidate’s research and scientific-applied activity

The scientific-research and scientific-applied activity of Assist. Prof. Eng. Daniela Spasova, Ph.D., is focused on the following areas:

1) “Research of materials and technologies applicable to equipment in the marine and mining industry”, reflected in publications B.4.1 + B.4.10, united as equivalent to a monographic thesis.

2) “Development of new and improvement of existing methods and technologies for making casting molds and obtaining complex non-technological castings from various alloys” – in publications Г.8.1, Г.8.2, Г.8.3, Г.8.16 and Г.8.18.

3) “Conducting research on technologies for the production of composite materials and evaluating their quality and properties” – in publications Г.8.5, Г.8.6, Г.8.7, Г.8.8 and Г.8.14.

4) “Research application of software products for automation of data processing and modeling of thermal processes” – in publications Г.7.1 and Г.8.10.

5) “Increasing the strength and operational characteristics of construction materials through additional applied technological processes” – in publications Г.8.4, Г.8.9, Г.8.11, Г.8.15, Г.8.17 and Г.8.19.

6) “Conducting research, quality control and restoration activity on the operational condition of production sites” – in publications Г.8.12 and Г.8.13.

It makes an impression the clear wording and the sufficient importance of the 6 highlighted areas in which the candidate's research is concentrated.

4. Assessment of the candidate's pedagogical training and activity

From the attached reference on the study loading for the last three years of Assist. Prof. Eng. Daniela Todorova Spasova, Ph.D. it can be seen that she has led lectures in 2 disciplines for each of the first two educational and qualification degrees (EQD), and their total horary is 300 hours. The colleague also has conducted 1130 hours of exercises on 8 bachelor's and 3 master's courses.

To these facts must be added the 7 graduates from the “Bachelor” and 4 from the “Master” EQD supervised by Mrs. Spasova, also documented with an official reference.

The scope of the teaching activity carried out by the candidate shows his sufficient pedagogical training and qualities for occupying the academic position “Associate Professor”.

5. Basic scientific, scientific-applied and applied contributions

The candidate's contributions are listed separately for the two main groups of works.

- Based on the first of them, covering the 10 publications in editions that are referenced and indexed in world-renowned databases with scientific information and are united as equivalent to a monographic thesis, 5 scientific-applied and 3 applied contributions are claimed, namely:

Scientific-applied contributions

1. An innovative production method for obtaining metal matrix composites (MMCs) with a controllable geometry of the reinforcing phase and the metal matrix has been created, which leads to an increase in the mechanical and operational properties of the obtained materials – in publications B.4.1, B.4.2 and B.4.5.

2. During the obtaining of MMCs with a metal strengthening phase, an interaction of the liquid metal matrix with the strengthening phase was established, as a result of which new phases and structures are formed, leading to an increase in mechanical properties that cannot be obtained with conventional casting methods – in publication B.4.1.

3. Various types of composite materials with a polymer matrix suitable for the manufacture of equipment operating in a marine environment, with mechanical properties close to metallic materials and with a significantly lower density, have been created – in publications B.4.3, B.4.4 and B.4.9.

4. A simulation model was created for selecting the operating mode and determining the durability of materials tested for cyclic fatigue, by which the natural resonance frequency of the tested materials and the approximate number of load cycles are calculated – in publication B.4.6.

5. A methodology has been developed to establish the modes of crack development depending on the chemical and technological conditions during cyclic fatigue loading and subsequent destruction of the studied samples – in publications B.4.6, B.4.7 and B.4.8.

Applied contributions

1. The created method for the production of MMCs with a ceramic reinforcing phase applicable in the mining industry ensures a stable mechanical connection between the matrix and the reinforcing phase, due to the coercive infiltration of the melt into the capillary spaces of the reinforcing phase, which helps to overcome the surface tension of the melt and ensures good wetting of the reinforcing phase – in publications B.4.2 and B.4.5.

2. A technology has been developed to adhesively bond of two types of polymer matrix composites (PMCs) with a matrix composed of different resins, which leads to an increase in the complex properties of standard PMCs by combining the better properties of both matrices – in publication B.4.9.

3. The reasons for the destruction of materials used in the engineering and mining industry have been experimentally determined, based on which recommendations to the manufacturer for quality control of the technological production process have been drawn up – in publications B.4.8 and B.4.10.

- From the second main group of works, including the 20 publications that do not fall into the previous category, the author has claims for a total of 13 scientific-applied and 8 applied contributions, namely:

Scientific-applied contributions (total for the 5 districts in this group)

1. A vacuum pulse casting technology has been developed enabling the production of thin-walled, solid castings with complex relief and significantly reduced production costs compared to conventional technologies – in publications Г.8.1 and Г.8.2.

2. A methodology has been developed for obtaining a ceramic shell on an electrically non-conductive wax model, which exactly copies the model block, as a result of a chemical method of creating an electrically conductive layer, and makes it possible to control the thickness of the formed shell, depending on the technological requirements for the casting mold – in a publication Г.8.3.

3. A methodology has been created for the formation of a surface layer between two liquid phases (coating of the mold and melt) of castings from aluminum and copper alloys, due to the formation of a temperature field ensuring contact of the melt with the coating, while both are in a liquid state, as per thus, a casting surface is formed on a liquid phase, providing lower roughness – in publication Г.8.16.

4. It has been established a possibility of applying the “capillary molding” method in the production of two-layer casting molds (using different coatings)

according to fusible models, to obtain castings with low roughness from non-ferrous alloys – in a publication Г.8.18.

5. The developed methodology for obtaining MMCs leads to the successful infiltration of the melt into the capillary spaces between the particles of the reinforcing phase, as a result of which a dense structure is obtained, without the presence of significant defects, and the resulting composite successfully copies the complex relief of the form – in publications Г.8.5, Г.8.6, Г.8.7 and Г.8.8.

6. It has been found that randomly oriented fibers used as a reinforcing phase, at polymer matrix composites lead to better strength properties of the constructed composite than composites with mesh-type reinforcing material, because randomly distributed fibers lead to isotropicity (identical properties regardless of the orientation of the reinforcing phase), in contrast to the mesh, which leads to anisotropic properties due to a dependence on the direction of orientation of the fibers in the bulk of the composite – in publication Г.8.14.

7. Engineering software based on DPs has been created for the calculation of stresses and strains in pre-insulated connected pipe systems for heat transfer networks, which, although rudimentary, reduces the design effort by leading to the automation of data processing – in publication Г.7.1.

8. A mathematical model of the thermal interaction between the matrix and the reinforcing phase forming MMCs has been created, which reveals the main mechanisms that control the formation of complex structures at the construction of cast metal composites by the “capillary molding” method – in publication Г.8.10.

9. A technology has been developed to increase the wear resistance of medium-carbon, low-alloy steel, in dry friction conditions by welding with abrasive wear-resistant electrodes – in publications Г.8.4 and Г.8.17.

10. The influence of the carbon and chromium equivalent values on the wear resistance of welded layers with abrasive wear-resistant electrodes was investigated – in a publication Г.8.17.

11. A vacuum cementation regime has been developed with a reduced temperature compared to the conventional cementation method, which allows obtaining a surface without the presence of an oxide layer – in publication Г.8.11.

12. A methodology has been developed for determining the degree of aging of nitrogenous ferrite below 100°C, after low-temperature gas carbonitriding and subsequent quenching – in a publication Г.8.15.

13. A methodology has been developed for the analysis and control of the safety of products used in the production of rescue equipment – in a publication Г.8.12.

Applied contributions (total for the 5 districts in this group)

1. The thickness and type of membranes used at vacuum impulse casting have been confirmed, to obtain practically maximum pressurization of the mold, which increased the degree of filling of the casting mold by about two times – in publications Г.8.1 and Г.8.2.

2. It has been established that the application of the “capillary molding” method for the production of two-layer casting molds according to melting models

lowers the heating temperature of the casting mold by several hundred degrees, which leads to a lower energy consumption of the process and also to obtaining a mold without cracks, as opposed to the conventional fusible pattern casting method – in publication Г.8.18.

3. The created methodology for obtaining MMCs is economically expedient, due to the lowered temperatures in the process of their construction and the possibility of making the composites in easy-to-make, conventional casting molds – in publications Г.8.5, Г.8.6, Г.8.7 and Г.8.8.

4. Extending the functionality of the software system for calculating stresses and strains in insulated pipe systems, which takes into account the change in length, by adding: compensator sizing; linear extensions in tees; dimensioning of the number and length of pads, as well as other calculations – in publication Г.7.1.

5. A laboratory bench for testing on wear intended for metal specimens with flat and cylindrical surfaces was constructed and developed, with the possibility of changing the friction conditions and test parameters – in publications Г.8.4 and Г.8.17.

6. A mode of heat treatment of aluminum rims made of AlSi7Mg alloy has been established, which improves the structure of the material, enhances the mechanical properties, and at the same time does not lead to an increase in the volume of defects (pores) – in a publication Г.8.9.

7. A technological process has been developed for strengthening welded products from austenitic and duplex corrosion-resistant steels, through low-temperature gas carbonitriding, leading to the formation of an “s”-phase, which significantly strengthens the products and improves corrosion resistance – in a publication Г.8.19.

8. An economically expedient technology was developed, saving time and money, for repair and restoration activity in a working environment of GS50CrV4 spring steel rails – in publication Г.8.13.

In accordance with the positive finding in item 2, it can be argued that all contributions claimed are the applicant’s personal work. Among listed ones of a scientific-applied nature, I would single out those with numbers 1, 2 and 5 from the first main group, and with numbers 1 and 9 from the second. It makes an impression the large number of scientific-applied and applied contributions (18 and 11, respectively) due to their too detailed presentation. In my opinion, this can be avoided by properly summarizing some of the contributions presented. In addition, the wording of the applied contributions No. 1 of the first main group and No. 4 of the second need refinement.

6. Significance of contributions to science and practice

The significance of the candidate’s contributions is beyond doubt. Their practical focus would lead to essential improvements in the technical-economical indicators of the respective productions, where they can be applied.

It has already been stated that there is compliance with the quantitative indicators of the minimum national requirements for occupying the academic position “Associate Professor”.

7. Critical notes and recommendations

I have no remarks in principle regarding the presented by Assist. Prof. Spasova scientific works.

It is appropriate to recommend the candidate to prepare a textbook or teaching aid that would support his activity as a habilitated teacher and would improve the quality of the students' education.

8. Personal impressions and opinion of the reviewer

I do not know Mrs. Spasova personally, but from the materials presented for the competition it appears that she has extensive scientific and practical experience. It has enabled her to select actual and relevant topics for her research and also to present them appropriately as scientifically and technically well-formed works.

From the attached documents, beyond those covered in the previous mandatory items, the following facts and circumstances make a good impression, which further shape the image of the candidate as a complete scientist, capable of developing both independent research and leading younger colleagues in team activities: development of 12 study programs for EQD “Bachelor”, participation in the organizing committee of 1 international conference and chairing a session in another, 18 participations in scientific conferences, seminars and symposia, availability of additional qualifications, awards, certificates, international mobility, membership in 2 professional organizations and others activities.

CONCLUSION

Based on familiarization with the presented scientific works, their significance, the scientific-applied and applied contributions contained in them, as well as the fulfillment of minimum national requirements for the acquisition of the academic position “Associate Professor” according to the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its application and the Regulations for the terms and conditions for occupying academic positions at the Technical University – Varna,

I consider it reasonable **to propose** Assist. Prof. Eng. Daniela Todorova Spasova, Ph.D to occupy the academic position “Associate Professor” in the professional direction 5.1. “Mechanical Engineering”, in the scientific specialty “Materials Science and Technology”.

23.04.2024

REVIEW
(Prof. E

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по Регламент (ЕС)
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