REVIEW

For the competition for occupation of the academic position of Associate professor in professional field 5.1. Machine engineering, scientific specialty Applied mechanics (mechanics of coatings) announced in State gazette issue 5 from 17.01.2020
With single applicant Senior assistant Eng. Polina Ilieva Milusheva-Mandadzhieva, PhD

by
Prof. Eng. Georgi Dimitrov Kostadinov, PhD
ISSAPP "N. Pushkarov", professional field
5.1. Machine engineering, scientific specialty
„Mechanization and electrification of agriculture"
Designated by Order № RD-111/01.06.2020 г.
Of the Rector of the University "Prof. Dr. Asen Zlatarov" for member of the scientific jury

1. General data about the carrier development of the candidate.

The candidate for the present competition Senior assistant Eng. Polina Milusheva-Mandadzhieva, PhD was born in 1970 in Bourgas.

She graduated the Technical School of mechanical engineering "Georgi Dimitrov"-Bourgas, specialty Technology of machine building – cold processing. She worked for three years in Metal products plant "Georgi Dimitrov in Bourgas.

From 1990 to 1993 she studied in the Institute of Machine building and electrical engineering "Hristo Smirnenski" - Bourgas, specialty "Technology of machine building and instrument building. In 1998 she graduated the Engineering and pedagogical Faculty, Sliven, with master's degree - Machine engineer with pedagogical qualification.

From 2009 to 2011, she was part0time lecturer at the University "Prof. Dr. Asen Zlatarov"- Bourgas, Faculty of technical sciences, Department of "Electronics, electrical engineering and machine engineering".

From 2011 to 2015 she was assistant professor at the same Department.

In 2016, she defended her PhD thesis entitled "Metal coatings on polymeric materials" at TU Sofia, Engineering and pedagogical faculty – Sliven and was awarded with the scientific and educational degree "Philosophy doctor" in professional field 5.1 Machine engineering. Since then she is Senior assistant and during this period she obtained master's degree on Industrial management at the same university.

The candidate is member of the USB and the Editorial board of the journal "Science, Education, Culture".

The candidate is fluent in English and Russian languages and has good computer literacy – good command of MS Office, AutoCAD, Autodesk Inventor 3D CAD, Photoshop, Corel Draw.

2. General description of the presented materials.

For the competition for the position of Associate professor, Senior assistant Eng.

Polina Milusheva-Mandadzhieva submitted 40 scientific publications in the field of nomenclature specialty, among them:

- publications related to the PhD thesis – four pieces and authors summary of the thesis which are not subject of reviewing;

- 10 publications in journals referred and indexed in world known databases with scientific information (group of indicators V);

-publications in non-referred journals – 30 pieces (groups of indicators G) among which 17 published in collections of scientific reports.

Additionally, the candidate, on suggestion of the reviewers, presented two other publications in the group of indicators G. One of them is published in a journal referred and indexed in world known databases. All the papers presented correspond to the nomenclature specialty of the competition.

13 papers produced by the candidate are published in English language and one in German.

29 of the scientific publications presented have been reported at conferences – 1 abroad and 28 to the scientific college at 21 international and national conferences in Bulgaria. The candidate has reported 69% of her scientific results at conferences. In my opinion, this ratio between the papers published in scientific journals and in collections of reports is good and indicates that the candidate is recognizable in the scientific community.

The personal participation of the candidate in the 42 scientific papers discussed is illustrated by the fact that she is single author in 19 of them and second author in 10 papers. All this illustrates her leading role in the publications (in 69% of the publications she is the only or first author) and indicates for the competency accumulated on the topic considered here. The candidate submitted also Protocols for equal contribution in the proposed joint publications.

3. Analysis of the compliance with the minimum requirements

The candidate has successfully defended her PhD thesis which covers the requirements in group A1.

From the information presented in group V4-1, I cannot accept one of the publications as it has been used in the procedure for the obtainment of PhD degree. The candidate, probably due to lack of knowledge, has included one publication (G8-4) which had been published in a journal with JSR, section G8. I transfer this publication to section V4-1 to replace the publication rejected by me and so the candidate complies with the requirements for 10 publications and collects 473,33 points to cover the requirements for this group, too. These 10 publications are subject to reviewing.

From the information presented in group G8, I do not accept three publications (G8-1, -3 and -9) which have been used in the procedure for the obtainment of PhD degree, as well as three in sources which I couldn't find in the National Reference List. One of the additionally submitted publications, which is in press as certified by the editors, is in group G7. The other publication presented is in group G8 (G8-31). Thus, a total of 25

publications remain for reviewing in group G. the candidate complies with the national requirements and these of the University for this group as she has a total of 312 points.

The review of the evidence presented and comparing it to the suggestion of the candidate concerning the citations found I can summarize that, in my opinion, there are 17 citations in journals referred and indexed in world-known databases with scientific information and 12 in in non-referred journals with scientific referencing. There are another 4 citations but I do not accept them since they cite the PhD thesis of the candidate which is not a publication. The points count by this indicator is 194 and this covers the national requirements and these of the University for this group.

Within group E, the candidate shows participation in one international project, one textbook, one collection of problems and two patent applications. Thus, the candidate accumulates 120 points, which covers the national requirements and these of the University for this group.

4. Main fields of research work of the candidate. Proven skills and faculties for managing scientific research.

The main fields where the scientific and applied research efforts of the candidate are focused are mechanics and materials science and can be summarized in the following directions:

1. *Depositions of metal, graphene and wear-resistant coatings onto polymers.;*
2. *Studies on the mechanical characteristics of deposited coatings and the surface properties of thin films;*
3. *Simulation studies and optimization of mechanical structures with coatings deposited on them;*
4. *Other directions.*

Her scientific activity is connected also with participation in five scientific research projects within the Scientific Research Sector of University "Prof. Dr. Asen Zlatarov".

5. Pedagogical activity

The candidate has also substantial pedagogical activity. It can be seen from the information about the lecturing activity during the last three years that for the academic year 2017-2018 the candidate has given lectures to the students studying for the educational and qualification degrees of Bachelor and Master for 482,8 and 30 academic hours, respectively, for the academic year 2018-2019 – 505 and 90 hours and for 2019-2020 – 480 and 105 hours.

The candidate was scientific tutor of three diploma students from the EQD Master and produced one review of a diploma thesis. She has taken part in the development of new curricula for the EQD Bachelor, regular form of education in the discipline "Technical mechanics" for the students of five specialties of the Faculty of technical sciences. She has participated in the update of seven educational curricula for EQD Bachelor, regular form of education in the discipline "Technical mechanics for students of the Faculty

of technical sciences. She has developed a lecture course for EQD Bachelor on "Technical mechanics" for the students of the specialty "Software engineering" and "Computer systems and technologies" and a course on "Resistance of materials-I" for the students of the specialty "Technics and technologies in transportation". The candidate also developed two lecture courses for EQD Master, regular form of education, one for the discipline "Computer modelling" and one for the specialty "Engineering design" at the Faculty of social sciences - "Printing and preprint preparation".

An information is supplied also which certifies that the disciplines "Technical mechanics", "Mechanics", "Mechanics-I" and "Resistance of materials" are permanent part of the curricula for a number of specialties at the University which ensures the lecturing activity of the candidate in this scientific specialty.

The candidate has more 3 years' experience as Senior assistant.

6. Significance of the contributions to the science and practice. Well-grounded answer to the question to what extent has the candidate clearly outlined profile of the scientific research work.

With the studies and developments carried out by the candidate and the results presented to the scientific community through her publications, certain contributions have been made with interest to science and practice. In principle, as amount of work and results obtained, I accept the information about the contributions supplied by the candidate. She has clearly outlined research and pedagogical profile. The contributions of the candidate are of scientific, applied scientific and applied nature and can be classified into the following groups:

PROVING BY NEW MEANS OF ESSENTIAL NEW ASPECTS OF ALREADY EXISTING SCIENTIFIC AREAS, THEORIES AND HYPOTHESES

A new approach was suggested for deposition of wear-resistant coating onto polymeric surface using fluidized bed of aluminium oxide Al_2O_3. [V4-8].

It was proved that the substrate material has significant effect on the wear-resistance and adhesion of the coating while the technological regime affects the elasto-plastic characteristics of the coating [V4-2, V4-5, V4-7, G7].

A method was suggested for simulation prediction of the mechanical characteristics of the deposited coatings. The possibility for particular implementation of the simulation model for prediction of the mechanical properties of metal coatings deposited onto machine parts manufactured from the polymeric material POLIPOM®-POM was proved [V4-2, G8-27, G8-30].

The possibilities for particular implementation of the technology for high-frequency cathode sputtering in vacuum to obtain thin layer resistive films and their use in hybrid and monolith integral circuits was proved. It was proved that the electrophysical parameters of the layers obtained undergo substantial changes after thermal treatment. It was proved that the planar cathode target simplifies the realization of the process, as well as

the possibilities for industrial implementation [G8-4, G8-7].

A general equation describing the motion of the material of polymeric structure without its destruction was derived. To increase the reliability of aircraft, the use of composite materials was suggested [G8-19, G8-20].

A kinematic method expanding the opportunities for analysis and estimation of the dynamic processes in the snap and crackle points in particular cases of point motion [G8-16, G8-17].

DEVELOPMENT OF NEW CLASSIFICSTIONS, METHODS, STRUCTURES, TECHNOLOGIES

The dependence between the adhesion of coating deposited onto various polymeric construction materials by magnetron sputtering of the metals X18H9T, Ti and Al and the cathode cleaning of the polymer surface as well as the wear-resistance of the coatings [V4-3, V4-4, G8-9, G8-10, G8-13].

The values of the technological parameters of the regime of cathode sputtering by the deposition of Ni-Cr and TiN coatings onto polymeric substrates PS/SB190 crystal, PS/SB793 shockproof and POLIPOM®-POM by direct current magnetron sputtering in vacuum were experimentally determined. It was proved that the optimal values of the mechanical characteristics of PS/SB190 crystal, PS/SB793 shockproof are obtained when the technological regime does not involve cathode cleaning while for POLIPOM®POM – treatment with oxygen [V4-3, V4-4, V4-5, V4-6, G8-8, G8-13, G8-14, G8-15, G8-25].

A possibility was substantiated and a technology for purification of waste waters was suggested. The possibility to use the cathodes obtained from the recovery of copper, nickel and chromium as targets for deposition of metal coatings by direct current magnetron sputtering in vacuum [G8-11, G8-12, G8-18].

OBTAINMENT AND PROVING NEW FACTS AND CONFIRMING KNOWN ONES AND IMPLEMENTATION OF NEW STRUCTURES AND TECHNOLOGIES

It was proved that the deposition of coatings onto polyamide structures Polipa®PA6 and Polikes®PA6G by direct current magnetron sputtering is inappropriate since, according to the opinion of the authors, it is accompanied by excessive gas release from these polymers [V4-8].

It was proved that the determination of the hardness of thin metal coatings is possible only when nano-hardness meters designed for measurements of coatings with thickness ranging from 3 to 0,7 μm are used. The regimes and conditions for carrying out such studies are chosen with respect to the tensile characteristics, thickness and the adhesion of the coating studied [V4-9, G8-6, G8-8, G8-21, G8-29].

The rate of deposition of Pt-SiO_2 resistive layers onto substrate of polytetrafluoroethylene by high-frequency sputtering was experimentally determined. [G8-4].

The regimes of deposition of copper nano-coating by high-voltage technology of deposition onto polymeric material in vacuum onto polymeric material Polikes®PA6Gwere experimentally determined. The structure of the coating was established. Particular optimal regimes of the high-voltage sputtering of Cu were developed [G8-31].

APPLIED RESEARCH CONTRIBUTIONS (IMPLEMENTATION OF STRUCTURES)

Optimal regimes of high-voltage sputtering of graphite electrode in vacuum onto polymeric material PS/SB793 shockproof were determined and the microstructure of the coating obtained was established [V4-9, V4-10, G8-28].

Physical model of the pair "coating-substrate" was developed using a mathematical model describing the forces arising in the system under the influence of an external load [G8-30].

A mathematical model for determining and prediction of the serviceability of a ship after impact was developed [G8-24].

Using computer modelling and investigating the three-dimensional models of various structures, results were obtained which helped design a radial-axial bearing assembly for turbine working with Freon [G8-26].

The influence of hydrogen on the combustion process and the possibilities to add it to the fuel for diesel engines was established [G8-22, G8-23].

7. Critical remarks and recommendations.

I would like to suggest the candidate to consider the following recommendations for her future work:

1. The key words in the publications should be carefully selected. They should be meaningful and one of the most common phrases or words present in the text rather than existing as keywords only in some cases.

2. In conclusions, the author should avoid describing what had been done but give priority to the results obtained.

3. The conclusions should be based on the analysis of the results obtained made in publication body text; this analysis is missing in a number of publications and, furthermore, there are figures in some publications, which are not discussed by the author! The reader expects to learn the author's opinion on the processes and tendencies observed and what is the reason for them!

4. I would recommend the author to analyze the dimensions before using formulae.

3. The citations observed should be described by full bibliographic description indicating which paper has been cited and where. The number of citations is counted rather than the number of publications cited.

8. Personal impression and opinion of the reviewer.

I am not personally acquainted with the candidate for the competition. However, I

am impressed by the volume and range of her production. She works in a perspective scientific field. She searches for and finds scientifically intense problems, has ideas and suggests solutions. She is recognizable in her scientific field. This defines him as a well-established and recognized scientist and specialist in his field, which is a prerequisite for his future development.

CONCLUSION

On the basis of the analysis of the scientific, applied-scientific and pedagogical activity of the candidate, I consider Senior assistant Eng. Polina Ilieva Milusheva-Mandadzhieva, PhD, complies with the requirements of Law for the development of the academic staff and the Regilations for application of this law, as well as with the Regulations for its application in the University "Prof. Dr. Asen Zlatarov" for the occupation of the academic position of "Associate professor".

The candidate for the competition is well-established scientist and lecturer. With her scientific, educational and applied scientific production presented, she proved to be a scientist able to orient herself in modern directions of scientific research work, to select, to look for the novel, to formulate and solve specific problems, to skillfully combine the work of a scientist and lecturer.

Giving high estimation of her scientific and pedagogical activity and taking into account her overall activities as scientist and lecturer, I think that her production fully corresponds to minimal national scientometric requirements and the requirements according to the Regulations for the conditions and procedures for acquiring scientific degrees and occupation of academic positions in the University "Prof. Dr. Asen Zlatarov" for the acquisition of the academic degree "Associate professor". All this gives me enough ground to estimate positively her overall activity and to suggest the honorable scientific jury to also vote **POSITIVELY** and suggest the Faculty council to elect Senior assistant Eng. Polina Ilieva Milusheva-Mandadzhieva, PhD, as Associate professor in the professional field 5.1. "Machine engineering", scientific specialty "Applied mechanics (Mechanics of coatings)".

Date: 05.08.2020 г.

Sofia

REVIEWER: ...

(Prof. Eng. G.Kostadinov, PhD)