R E V I E W

with respect to the competition for an academic position "Associate Professor" in scientific area 5. Technical sciences,
professional field 5.1. Mechanical Engineering,
speciality "Technology of Mechanical Engineering",
announced in the State Gazette no. 57 of June 26, 2020 and on the website of Paisii Hilendarski University of Plovdiv.

applicant: Senior Assistant Professor, PhD, Eng. Velko Slavchev Rupetsov
reviewer: Professor, DSc, Eng. Vasil Stefanov Kostadinov
According to Order P33 – 4124/24.08.2020 of the Rector of PU "Paisii Hilendarski".

1. General situation and biographical data

The competition has been announced for the needs of the Department of Mechanical Engineering and Transport, Faculty of Physics and Technology. According to the announced competition, documents were submitted by only one applicant – Senior Assistant Professor, PhD, Eng. Velko Slavchev Rupetsov.

Velko Slavchev Rupetsov was born in Smolyan in 1965. He graduated from "Angel Kanchev" University of Ruse with a degree in "Complex mechanization and production lines in mechanical engineering" with additional specialization "Robotics, robotic systems and FAMS". In 2015, he defended his doctoral dissertation "Increasing of the wear resistance of parts and tools for production equipment in the food industry". He began his professional career at the Institute of Mechanical Engineering and Transport of Smolyan as a constructive engineer and organizer of teaching and production activities (TPA) in 1991 and continued as an assistant and chief assistant until 1998. From 1999 to 2015 he was a senior assistant at Plovdiv University "Paisii Hilendarski", Technical College - Smolyan, Department of Mechanical Engineering and Transport. Since 2015 he has been a senior assistant at Plovdiv University "Paisii Hilendarski", Faculty of Physics and Technology, Department of Mechanical Engineering and Transport.

2. General description of the presented materials

For the participation in the competition for associate professor, the applicant has submitted the following works:

2.1. An individual monographic work entitled "Increasing in the Durability of Machine Parts and Tools by Coating Deposition" – B.3.

The monograph is 128 pages long. It was published by Paisii Hilendarski University Publishing House, Plovdiv in 2020 with ISBN 978-619-202-560-1 and was reviewed by Prof. Georgi Atanasov Mishev, DSc, Eng. and Assoc. Prof. Ruslan Angelov Dikov, PhD, Eng.

2.2. A published book based on a defended dissertation for graduation of educational and scientific degree Doctor, entitled " Increasing the wear resistance of parts and tools of production equipment" - Г.6.

The book is 136 pages long. It was published by ZEA-Print Ltd., Smolyan in 2018 with ISBN 978-619-196-073-6 and was reviewed by Prof. Stefan Petrov Dichev, DSc, Eng. and Prof. Stefan Vasilev Stefanov, PhD, Eng.

2.3. A published university textbook (which can also be used in the vocational school network), entitled "Mechanical Engineering Technology, Technological Processes for the Processing of Types of Parts and Assembly of Products". The textbook is co-authored with 1 author and is 196 pages long. It was published by ZEA-Print Ltd., Smolyan in 2019 with ISBN 978-619-196-083-5 and was reviewed by Assoc. Prof. Stanislav Aleksiev, PhD, Eng.

2.4. A published university schoolbook (which can also be used in the vocational school network) - (2 items):

- Manual for Laboratory Exercises in Mechanical Engineering Technology, Part One. It was published by ZEA-Print Ltd., Smolyan in 2016. The manual is co-authored with 1 author and is 150 pages long having ISBN 978-619-196-037-8 and is reviewed by Prof. Georgi Atanasov Mishev, DSc, Eng.
- Exercises in Engineering Graphics (Workbook). It was published by Book Boutique Publishing House - Sofia in 2016. The workbook is co-authored with 1 author and is 62 pages long, having ISBN 978-954-92755-0-6.

2.5. The 27 scientific publications presented in the competition can be systematized as follows:

- Scientific publications in issues which are refereed and indexed in notable databases of scientific information – from Г.7.1 to Г.7.7 (7 pcs.);
- Scientific publications in non-refereed journals with scientific review or in edited collective works – from Г.7.8 to Г.7.27 (20 pcs.).

The total number of papers with which the applicant participates in the competition is 32.

I do not accept 5 papers for review for the following reasons:

- A publication mentioned in point 2.1: I mark but do not review it – 1 item;
- A publication mentioned in point 2.2: I mark but do not review it – 1 item;
- A publication mentioned in point 2.3: I mark but do not review it – 1 item;
- Publications mentioned in point 2.4: I mark but do not review it – 2 items.

I accept 27 papers for reviewing. The applicant's participation in the reviewed papers is as follows:

- Individual author of 4 works (Г.8.8, Г.8.9, Г8.10, Г.8.27);
- First author of 8 works (Г.7.1, Г.7.6, Г.7.7, Г.8.20, Г.8.21, Г.8.22, Г.8.24, Г.8.26);
- Second author of 6 works (Г.8.12, Г.8.14, Г.8.16, Г.8.17, Г.8.18, Г.8.23);
- Third author of 6 works (Г.7.2, Г.8.11, Г.8.13, Г.8.15, Г.8.19, Г.8.25);

- Fifth author of 1 paper (Г.7.5), sixth author of 1 paper (Г.7.3) and seventh author of 1 paper (Г.7.4).

All the papers are on the competition topic: there are 11 in Bulgarian, 15 in English and 1 in Russian.

3. General characteristics of the scientific research and the practical applications of the activity of the applicant.

All of the publications of Senior Assistant Professor Velko Slavchev Rupetsov, PhD, Eng. could be classified in the following main areas:

- Improving the tribological properties of the products by coatings deposition (В.3, Г.6, Г.7.1, Г.7.2, Г.7.3, Г.7.4, Г.7.6, Г.7.7, Г.8.20, Г.8.22, Г.8.27);
- Creation of innovative and nanolaminate coatings by Closed Field Unbalanced Magnetron Sputtering (CFUBMS) technology (Г.8.6, Г.8.7, Г.8.18, Г.8.19);
- Rheological studies of cooling lubricants (Г.7.5, Г.8.25);
- Installations and research equipment (Г.8.8, Г.8.9, Г.8.10, Г.8.24, Г.8.26);

The candidate also shows a significant research and development activity. As could be seen in the attached reference (11a), in the period between 2014 - 2020 the applicant participated in 5 projects, among them - 3 university (2 of Plovdiv University "Paisii Hilendarski and 1 of University of Food Technologies Plovdiv), 1 faculty and 1 national of the Ministry of Education and Science.

A reference and certificates for some of the scientific and scientific-applied works implemented in practice are presented.

4. Assessment of the pedagogical preparedness and activity of the applicant.

I evaluate the pedagogical qualification of the candidate and his work as a teacher at the level of the pursued scientific rank "Associate Professor", as he lectures the following disciplines for the bachelor's and master's degree courses:

- Mechanical engineering technology (general course);
- Mechanical engineering technology I and II part;
- Computer design of parts and assemblies of the machine building production;
- Automated preparation of technical documentation;
- Technical and computer documentation;
- Computer design of machines, processes and systems;
- Nanotechnologies in the machine building - CVD and PVD processes.

The candidate has participated in the teaching mobility "Erasmus+" program as a lecturer at the Polytechnic University of Bucharest, Romania.

Under his leadership, 32 graduates have defended their degree theses and he has reviewed the theses of 33 graduates. He has supervised 2 students at the Polytechnic University of Bucharest, Romania under the "Erasmus+" program. He has participated as an academic mentor of 6 students from the Technical College - Smolyan under the project "Student Internships".

5. Main scientific and practical contributions.

The contributions, contained in the candidate's works, could be classified in the following groups:

5.1 Scientific contributions (creation of new classifications, research methods, constructions and technologies):

- It has been proven that for multi-component coatings such as CrTiAlN and TiCrAlN, those based on Cr possess better mechanical properties than coatings based on Ti - higher hardness (≤ 31GPa) and higher scratch resistance (> 30N) - (4);
- A technology has been developed for deposition of multilayer CrN/TiN coatings at temperatures below 200 °C and their mechanical and tribological properties have been studied - (3).

5.2. Practical scientific contributions (obtaining and proving of new facts and creation of new classifications, methods, constructions, technologies, schemes).

- One wear model based on the principle of physical modeling has been proposed, using the cybernetic approach (the "black box" principle) (11).
- A multimedia interactive computer model has been created which enables work with static and dynamic images, including animation and text (16).
- It has been proven that the nanocomposite coating Ti/TiN/TiCrN-ml deposited on steel 1.2767, increases the wear resistance as follows: for unhardened ground surfaces 6 - 8 times; for hardened ground surfaces 10 - 13 times; for hardened polished surfaces 50 - 60 times (18).
- One nanolaminate coating Ti/TiN/AlTiSiN/(AlTiSiN/TiAlSiN)n/AlTiSiN has been created and its mechanical properties have been investigated (6).
- The innovative nanolaminate Ti/TiN/TiCrCN/(CrCN/TiCN)n hard coating deposited by CFUMS has been proven to be suitable for metal-ceramic (cermet) cutting tools used for precise high speed machining (HSM) of aluminum alloys (7).
- One methodology for experimental determination of tangential contact deformations under static load of the support has been proposed. The influence of the main technological parameters of the metal-cutting machines on the tangential contact deformations, respectively on the friction force, has been experimentally determined and the corresponding quantitative dependences have been derived (13).
- It has been shown that the specific wear intensity *Iw* has a relatively constant value which depends mainly on the quality of the surfaces and not on the conditions of their loading (18, 20).
- The main factors which influence on the accuracy of positioning of the systems for rectilinear motion in the production equipment have been determined. An equation has been derived to determine the maximal error (accuracy) of the positioning (23).

5.3. Practical contributions.

- It has been proposed that the profile curve of the shaft of the band saw blades flattening machine KL 160 to be made using an Archimedean spiral (9).
- One protective assembly has been designed which moves with the upper belt-guide and covers the working part of the belt above the log. A prototype of the assembly for ББ 110 has been made, as the proposed model could be implemented in all types of block band saws and dividing band saws, which have a mechanized movement of the upper belt-guide (10).
- One CC-1 stand has been designed and manufactured which reproduces the kinematic scheme of work of the elements of the piston-cylinder group (PCG). The stand serves to determine the influence of the test parameters on the technical condition of the PCG elements (11).
- One universal milling machine FNC 25E3 has been constructively changed and its technological capabilities for processing of rotary profile surfaces by milling have been expanded respectively (8).
- A technological process for repair of defective elements of a differential mechanism has been proposed (17)
- The rheological properties of different types of Cooling Lubricating Fluids (CLF) as a function of their chemical and physical characteristics have been evaluated experimentally and recommendations for their application have been given (5, 25).
- For the evaluation of the thickness of thin hard coatings, one calo tester has been designed and manufactured which is used in both the educational process and scientific research (24).
- The main tribological characteristics of multilayer coating Ti/TiN/CrN-ml (21), nanocomposite coating Ti/TiN/TiCN/nc-TiCN:a-C/nc-TiC:a-C/a-C (1) and gradient nanocomposite coating nc-$(Al_{1-x}Ti_x)N$/a-Si_3N_4 (2) have been studied.
- A software module for visualization of an involute gearing has been created which allows its realistic understanding (16).
- One equipment for combined coating formation using Electric Arc Deposition (EAD) and Magnetron Sputtering (MS) has been designed and manufactured, with which various nanostructured coatings with suitable industrial properties could be deposited (19).

5.4. Methodical contributions.

I appreciate that the presented textbook and manual for laboratory exercises (10б) are essential for the quality of the learning process.

The textbook and the manual are on the topic of the competition, they have been positively reviewed.

5.5 Citations.

There are 24 presented citations of papers, distributed as follows:

- In scientific issues which are refereed and indexed in notable databases of scientific information or in monographs and collective volumes – 3 items. (Д.12.1, Д.12.2, Д.12.3);

- In monographs and collective volumes with scientific review – 20 items. (from Д.13.1 to Д.13.20).
- In non-refereed journals with scientific review- 1 item. (Д.14.1).

6. Significance of contributions to science and practice.

There are significant scientific and practical application contributions, considerably enriching the theory, teaching material and practice in the field of the announced competition in the speciality "Technology of Mechanical Engineering".

As a result of the candidate's work, a rich base of theoretical and practical information about the structure, physico-mechanical and tribological properties of the developed coatings has been formed and an assessment of their industrial application has been made. Stands and methodologies for studying of the wear resistance and thickness of thin hard coatings have been developed and implemented.

A significant volume of the methodological and analytical part of the scientific activity of the candidate has been implemented in the teaching process.

The information presented in points 2 and 3 shows the applicant's recognition and gives reasons to claim that the majority of the contributions are his personal work or were obtained with his decisive participation.

The mentioned citations in point 5.5 prove the recognition of the candidate by the scientific community in our country and abroad.

The quantitative indicators of the criteria for getting the academic position "Associate Professor" are fulfilled. The indicators from groups Г and Д are overfulfilled.

7. Critical remarks and recommendations

I did not find omissions of a principled or debatable nature in the works of the candidate - such as literary ignorance, wrong statements, incorrect methodology, incomplete analysis or incorrect summarisation of the results. When the candidate publishing future works, I note that the conclusions and contributions to them must be specific and precise. There are notes of secondary importance which should be accepted as recommendations for the work of the candidate and the future team of assistants and PhD students led by him. They were submitted to him in advance.

8. Personal impressions and opinion

I do not know Velko Slavchev Rupetsov, PhD, Eng. personally. From the presented materials and his numerous participations in conferences and seminars, I got an impression about his competence and informedness. I believe that he has established himself as a qualified specialist and could be characterized as a recognized researcher and educator in the field of Technology of Mechanical Engineering (tribology and coatings).

His professional qualities as a technologist are also recognized by the Chamber of Engineers in the Investment Design (CEID), where the candidate has been a designer since 2004 with full design qualification in the Technological Section, and since 2016 he has held the elective position Chairman of Regional Professional Section "Technologies" at the Regional Board of CEID - Smolyan.

CONCLUSION

Based on my perusal of the presented scientific papers - their significance and the scientific, practical scientific contributions and practical contributions contained in them, I find it reasonable to give my positive assessment and recommend to the Scientific Jury to prepare a report-proposal to the Faculty Council of Faculty of Physics and Technology to choose Senior Assistant Professor, PhD, Eng. Velko Slavchev Rupetsov for the academic position "Associate Professor" at the University of Plovdiv "Paisii Hilendarski" in the professional field: 5.1. Mechanical Engineering, speciality: "Technology of Mechanical Engineering".

30.10.2020 REVIEWER:
Ruse /Professor V. Kostadinov, DSc, Eng./