

OPINION

in a Procedure for the academic position of "Associate Professor" in the field of higher education 5. "Technical sciences", professional field 5.1. "Mechanical Engineering", specialty "Technology of Mechanical Engineering", published in the State Gazette, issue. 57 of 26.06.2020 for the needs of the Department of Mechanical Engineering and Transport at the Faculty of Physics and Technology of Plovdiv University "Paisii Hilendarski", with candidate. Assist. Prof. Dr. Eng. Velko Rupetsov from the Faculty of Physics and Technology.

Member of the scientific jury by order P33-4124 from 24.08.2020.:

Prof. Georgi Todorov, DSc, PhD, Mag. Eng. FIT, TU-Sofia

1. General characteristics of the research and applied research activity of the Candidate

Presented by Assoc. Prof. Dr. Eng. Velko Rupetsov list of activities include a list of scientific papers; reference for compliance with the minimum national requirements; annotations of materials, including self-assessment of contributions; declaration of originality and authenticity of the attached documents; certificate of work experience; documents for teaching work; research documents; other documents.

The candidate has submitted a total of 32 scientific papers: 1 monograph, 1 book based on a dissertation, 1 textbook, 1 manual for laboratory exercises, 1 textbook and 27 scientific publications.

The listed 27 scientific publications, which are outside the PhD dissertation, I accept for review, as well as 4 textbooks and 5 research projects. The distribution of the scientific papers by respective rubrics, in the country and abroad, is as follows: 20 - in the country, 7- in referenced and indexed Journals. Documents for participation in scientific forums and for implemented results of scientific research in Arexim Engineering EAD, Ela Company - Smolyan and in FTF of PU "Paisii Hilendarski" for research and educational activities, as well as for their benefit are also presented from them.

The research, teaching and applied activity of the candidate is in the field of the announced competition. The candidate is well informed, and the topics, he works on are relevant for the industry both at Bulgaria and abroad. I believe that the research and applied research activities of Assist. Prof. Dr. Eng. Velko Rupetsov are in relevant areas for the industry, as he uses modern methods and tools to solve problems and achieve relevant goals.

2. Assessment of the pedagogical preparation and activity of the candidate

The educational and pedagogical activity of Dr. Rupetsov includes participation in 1 master's and 2 bachelor's courses. During this period he provided classes in 14 different disciplines: Technology of Mechanical Engineering - Part 1 and 2, Metal cutting machines and equipment, Machine elements, Computer aided design of elements and units of machine building, Automated development of technical documentation, Nanotechnologies in mechanical engineering - CVD and PVD processes, Computer design of machines, processes and systems, etc. In 6 of the disciplines the candidate conducts lectures and laboratory exercises, in 1 - lectures, and in the remaining - laboratory and seminar exercises. He was a lecturer at the Polytechnic University - Bucharest under the Erasmus +

program. He is the author of the curricula for 22 disciplines. The candidate has participated in the textbook "Technology of Mechanical Engineering, Technological Processes for Processing Type Parts and Assembly of Products" - with one co-author; Guide for laboratory exercises in mechanical engineering technology, part one (with one co-author). Ch. Assistant Professor Dr. Rupetsov was the supervisor of over 30 graduates. The above gives me reason to believe that the candidate has the necessary teaching experience and pedagogical training.

3. Main scientific and applied scientific contributions

Contributions to the candidate's work can be attributed to:

I. Scientific and applied contributions (obtaining and proving new facts and creating new classifications, methods, constructions, technologies, schemes; proving with new means of essential new aspects of already existing scientific fields).

- A technology for deposition of multilayer CrN / TiN coatings at temperatures below 200 ° C has been developed and their mechanical and tribological properties depending on the main technological parameters have been studied (3).
- It has been developed and proven that multicomponent coatings of the type of CrTiAlN and TiCrAlN (based on Cr) have better mechanical properties than coatings based on Ti. They have higher hardness (≤ 31 GPa) and higher scratch resistance (> 30 N). The influence of the CFUBMS process parameters on the properties of the coatings was studied (4).
- The Ti / TiN / TiCrN-ml nanocomposite coating deposited on 1.2767 DIN steel has been shown to increase wear resistance.
- A nanolaminate coating Ti / TiN / AlTiSiN / (AlTiSiN / TiAlSiN) n / AlTiSiN has been created and its mechanical properties have been studied, proving its practical application for cutting tools (6).
- The innovative nanolaminate (Ti / TiN / TiCrCN /) (CrCN / TiCN) n hard coating by CFUMS has been shown to be suitable for metal-ceramic cutting tools for precision high-speed machining of aluminum alloys (7).
- A model of piston-cylinder group wear has been proposed on the principle of physical modeling, using the cybernetic approach (the 'black box' principle) (11).
- A method for experimental determination of tangential contact deformations under static loading of the support is proposed. The influence of the main technological parameters of the metal - cutting machines on the tangential contact deformations, respectively the friction force, has been determined experimentally, and the corresponding quantitative dependences have been derived (13).
- It has been proven that the specific wear intensity I_w has a relatively constant value, which depends mainly on the quality of the surfaces and not on the load conditions, and it is recommended that the most responsible elements of the injection molds be hardened and polished before coating. (18.20).
- It has been proved that during the deposition of the multilayer coating Ti / TiN / CrN-ml and the nanocomposite coating Ti / TiN / TiCN / nc-TiCN: a-C / ncTiC: a-C / a-C by the method of unbalanced magnetron sputtering (UBMS) the initial roughness of the surface on which the coating is deposited does not change (1, 20, 22, 27).
- The main factors influencing the accuracy of positioning of the systems for rectilinear motion in the production equipment are determined. An equation is derived to determine the maximum positioning error (accuracy) (23).
- The derived correlations of the wear intensity of the normal force, the sliding speed and the friction path for the multilayer coating Ti / TiN / CrN-ml deposited on a hardened ground surface of 37Cr4 steel (22) have shown that the most the intensity of wear is greatly influenced by the normal force, and the least by the friction path.

II. Applied contributions

- A safety unit has been constructed, moving with the upper belt guide and covering the working part of the tape above the carcass. A prototype of the node for BB 110 has been made, and the proposed model can be implemented in all types of block chainsaws and dividing chainsaws, which have mechanized movement of the upper belt guide (10).
 - Stand SS-1 was designed and manufactured, which reproduces the kinematic scheme of operation of the parts of the piston-cylinder group (BCG). The stand serves to determine the influence of the test parameters on the technical condition of the BCG parts (11).
 - Structural changes have been made to the universal milling machine FNC 25E3, which expands the technological capabilities of the machine for processing rotary profile surfaces by milling (8).
 - A technological process has been proposed for the repair of defective elements of a differential mechanism (17).
 - The rheological properties of different types of lubricating and cooling fluids as a function of their chemical and physical characteristics have been determined experimentally and recommendations for their application have been made (5, 25).
 - A 'calotester' stand has been designed and manufactured to determine the thickness of thin hard coatings, which is used both in the teaching process and in research (24).
 - The main tribological characteristics of multilayer coating Ti / TiN / CrN-ml (21), nanocomposite coating Ti / TiN / TiCN / nc-TiCN: a-C / ncTiC: a-C / a-C (1) and gradient are determined nc-(Al_{1-x}Ti_x) N / a-Si₃N₄ nanocomposite coating (2).
 - A software module for visualization of involute gearing has been created, which allows for its realistic perception - (16).
- Equipment for the combined generation of coatings by electric arc deposition (EAD) and magnetron sputtering (MS) has been designed and manufactured, with which various nanostructured coatings with suitable industrial properties can be applied (19).

III. Citations

The 23 cited papers are distributed as follows:

- In scientific publications, referenced or indexed in a world-famous database with scientific information or in monographs and collective volumes - 3 pcs .;
- In monographs and collective volumes with scientific review - 20 pcs.
- In unreferred journals with scientific review - 1 pc.

4. Assessment of the personal contribution of the candidate

From the submitted scientific works of the candidate it can be assumed that there are significant scientific-applied and applied contributions in the field of the announced competition. A database of theoretical and practical information about the structure, physico-mechanical and tribological properties of the developed PVD coatings on steel substrates has been created. To study the wear resistance and the thickness of the coatings, stands have been constructed and methodologies have been created, which have been implemented in the teaching and research activities.

It can be seen that the scientific activity of the candidate is known to the scientific community. The presence of 24 citations of the candidate's works shows the interest that the candidate has aroused in the scientific circles at home and abroad.

The quantitative indicators of the criteria for holding the academic position of "Associate Professor" are met. In the works of the candidate there are original scientific and applied contributions, which have received international recognition and most of them are published in journals and scientific journals published by international academic publishers. His theoretical developments have practical applicability, as many of them are oriented to the educational work. I

believe that the candidate is a qualified specialist and a recognized researcher and educator in the field of mechanical engineering technology, and in particular in the field of PVD coatings.

5. Critical remarks and Recommendations

In the works of the candidate I did not find any fundamental errors or incorrect statements of a debatable nature. At the same time, there are a number of inaccuracies or omissions.

A number of publications lack detailed conclusions and summaries reflecting the scientific and applied contributions.

In some of the works an upgrade is noticed and a general impression of repetition is created.

CONCLUSION

Based on the materials presented in the competition and the scientific papers, their significance, scientific and applied contributions, as well as the overall creative and professional activity of the candidate as a lecturer and specialist, I can confidently recommend the esteemed scientific jury to evaluate positively the activity and scientific papers. of the candidate in the competition and to propose to the Faculty Council of the Faculty of Physics and Technology for election of Dr. Velko Slavchev Rupetsov to the academic position of "Associate Professor" at the University of Plovdiv "P. Hilendarski " by professional field 5.1. "Mechanical Engineering", specialty "Mechanical Engineering Technology".

03.11.2020 г.

Signature:

/prof. DSc. G. Todorov/