OPINION

by Prof. PhD Eng. Stoyko Atanasov Gyurov

According to the materials submitted to a competition for the academic position of "Associate Professor" in the field of higher education 5. Technical sciences, professional field, 5.1. Mechanical Engineering, scientific specialty “Structural Mechanics, Strength of Materials” announced by the Technical University of Gabrovo in the State Gazette issue 68 of 31.07.2020 with the only candidate Ch. Assistant Professor PhD Vladimir Petrov Dunchev

The report is based on: Order № 3-01-552/10.11.2020 of the Rector of TU Gabrovo for appointment of a scientific jury; according to a decision of the Faculty Council of the Faculty of Mechanical Engineering and Instrumentation, Protocol № 12 of 09.11.2020; and a decision of the scientific jury for selection of reviewers (Minutes of the first meeting of the scientific jury).

1. Overview of the content and results in the presented works

Ch. Assistant Professor PhD Vladimir Petrov Dunchev participated in the competition with 33 scientific papers and two published textbooks (in electronic format). All works deal with issues related to the topic (nomenclature) of the competition.

The scientific papers for participation in the competition are 24 publications and the two textbooks that I review. They are grouped in: Group B - Habilitation work - related scientific publications in international scientific journals with Impact Factor, indexed by Scopus and Web of Science, on the topic: "Increasing the fatigue strength of metal structural elements through static surface plastic deformation"; Group G- Publications outside the habilitation work.

- Peer-reviewed publications can be classified as:

Scientific publications in journals that are peer-reviewed and indexed in world-renowned databases with scientific information (Scopus and Web of Science) - **Eleven issues**. It is very impressive that three of them have a high impact factor of 3,031 for technical editions, four have an impact factor of 2,633, three have an impact factor of 1,755, and only one has an impact factor of 0.59.

- Scientific publications in unreferred journals with scientific review or in edited collective volumes - **Thirteen issues**.
- Presented at conferences - **Three issues**.
- Independent publications - **Six issues**.
- Co-authored publications - **Eighteen issues**, and in six the candidate is the first author.

Proof of the quality of scientific production of the candidate are citations of his work - fifteen in number in reputable journals.

The scientific works of the candidate can be referred to the following thematic areas: 1) Research related to the processes of surface treatment of various metal components in order to increase their fatigue strength and fatigue life, in correlation with Surface Integrity (SI) [B.1-B.6, B8, B.10, G2-G5, G7]. 2) Optimizations and new optimization procedures of static processes for surface plastic deformation [B.7, B.9, G.8]. 3) Temperature-dependent constitutive models of the behaviour of the surface layers of structural materials subjected to diamond burnishing [G.6, G.9, G.12]; 4) Investigation of the influence of the sliding velocity on SI in diamond burnishing [G.10, G.11, G.13, G.14]. Publication G1 develops engineering problems that are not related to SI and fatigue strength.

The reference under Art. 26, para. 1, of Law for development of the academic staff in the Republic of Bulgaria proves that the candidate meets the minimum national requirements for the position.

2. General characteristics of the candidate's activity

2.1. Educational and pedagogical activity (work with students and doctoral students)

The candidate holds the position of Chief Assistant at the Department of Technical Mechanics, Faculty of Mechanical Engineering and Instrument Making at the Technical

University - Gabrovo. The disciplines in which he lectured are: 1) Strength of materials; 2) Mechanics I; 3) Mechanics II; 4) Mechanics. The disciplines in which the candidate has conducted exercises are: 1) Strength of materials; 2) Mechanics I; 3) Mechanics II; 4) Mechanics; 5) Applied mechanics; 6) Technical mechanics; 7) Theoretical mechanics. Ch. Assistant Professor PhD Dunchev is the author of "Methodical guide for solving problems in statics" and "Guide for solving problems in kinematics".

2.2. Scientific and scientific-applied activity

Chief Assistant PhD Dunchev has participated in the following projects: 1) Project funded by OP "Science and Education for Smart Growth" BG05M20P001-1.002-0023 - Center of Competence "Intelligent mechatronic, eco- and energy-saving systems and technologies"; 2) Project funded by NF "Scientific Research" № BG051PO001-3.3.06-0008 "Supporting the growth of scientific personnel in engineering and information technology" - Operational Program "Human Resources Development". 3) Research projects funded by the University Research Fund: 3.1) Project M1408; 3.2) Project D1601M; 3.3) Project 1702M; 3.4) Project 1801M; 3.5) Project 2001M.

2.3. Implementation activity

The implementation activity of the candidate is related to maintenance, renovation and modification of laboratory installations and machines at TU Gabrovo.

The candidate has participated in: 1) Modification of a MUI6000 rotary bending fatigue test machine by adding a cooling module. 2) Renovation of a UMB rotary bending fatigue test machine for test fixtures with cantilever mounting scheme and test fixtures with "simple beam" mounting scheme. 3) Modification of a universal Brinnel hardness tester, allowing heating of the test specimen. 4) Laboratory test machine for experimental determination of sliding friction and rolling friction coefficients for different friction pairs.

3. Contributions (scientific, scientific-applied, applied)

I accept the report on the candidate's contributions, which is very extensive. More generally, the contributions to the work of Chief Assistant PhD Dunchev are:

3.1 Scientific contributions

1) For the first time a hypothesis has been substantiated and proved experimentally that materials which are getting stronger under the cyclic deformation reach maximum values of the fatigue limit when the surface layer reaches a stabilized cycle [B.5].

2) Original data were obtained for the correlation between different combinations of process parameters for surface plastic deformation with some basic characteristics of SI (obtained roughness, residual stresses, microhardness, microstructure) and with fatigue life and fatigue limit, which allows to control and predicts fatigue behaviour by SI control [B.1-B.6, B8, B.10, G2, G3, G4, G5, and G7].

3) New optimization procedures of static processes for surface plastic deformation have been developed [B.7, B.9, and G.8].

4) Mathematical models have been developed for the behaviour of the surface layers of structural materials subjected to surface plastic deformation by different methods [B2, B4, B.6, B.7, B.9, B10, G1, G3-G6, G8, G9, G12, and G14].

3.2 Scientific and applied contributions

1) It has been experimentally proven that:

- diamond burnishing leads to a greater increase in the fatigue limit compared to the roller burnishing and deep rolling processes [B.8]; - fatigue cracks are formed at the boundary between the affected surface layer and the bulk material [B.1, B.3]; - the optimal process of ionic nitriding, with respect to the fatigue limit, is at a temperature of 520 °C and a duration of 4 hours [G.2];

2) Original data were obtained on the influence of the sliding speed in diamond burnishing on SI [G.10, G.11, G.13, and G.14].

3) Data on fatigue limit and fatigue life were obtained for various structural materials treated with diamond burnishing [B.1, B.2, and B.6].

4) Effectivity of static processes for surface treatment is proven experimentally that improve the SI, respectively increasing the surface microhardness and depth of the hardened layer [B.2-B.5, B.8-B.10].

5) A 3D model has been developed of the residual hoop stresses around joint bar holes, obtained by loading a guide node from railway rails with and without diamond burnishing of the guide holes [B.4].

3.3 Applied contributions

1) Both Wöhler's curves and databases of SI characteristics and fatigue limits have been obtained for various materials subjected to surface treatment processes [B.1-B.10].

2) Both Wöhler's curve and a database on the fatigue limit has been obtained for 35HGS steel subjected to ionic nitriding of different duration and volumetric hardening and grinding [G.2];

3) A database has been created for the influence of the main parameters of the process for surface treatment with a toroidal deforming roller on the obtained roughness of test bodies of high-strength aluminium alloy 2024-T3 [G.7].

4. Assessment of the personal contribution of the candidate

Publications in journals referred to Scopus and Web of Science (eleven in number) are tested for plagiarism. The rest of the works develop the same scientific problems, so I have no doubts about the personal contribution of the candidate in the works submitted for the competition.

5. Critical remarks and recommendations

I do not have critical remarks and recommendations that would call into question the scientific and scientific-applied contributions of the candidate. It is surprising to me that with such valuable results in scientific works there are no patents!

There is no reference for the graduates led by the candidate.

Conclusion:

Having in mind the above, I propose Ch. Assistant Professor Dr. Vladimir Petrov Dunchev to be elected "Associate Professor" in the field of higher education - 5. Technical sciences, professional field - 5.1. Mechanical Engineering, scientific specialty "Structural Mechanics, Strength of Materials" at the Faculty of Mechanical Engineering and Instrumentation, Technical University of Gabrovo.

07/12/2020 **Jury member:……/signature/……..**

Sofia / Prof. PhD Eng. Stoyko Atanasov Gyurov /