

OPINION

prepared by

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based on the materials submitted to the competition
for the academic position “Professor”
in the field of – 5. Technical sciences,
by professional field of study – 5.6. Materials and Materials Science,
specialty - Materials Science and Technology of Engineering Materials

The only candidate in the competition for professor, announced in the State Gazette, issue 47/24.06.2022, as well as on the website of TU-Gabrovo, for the needs of the Department of Materials Science and Mechanics of Materials at the Faculty of Mechanical Engineering and Engineering, is Assoc. Prof. Dr. Angel Petrov Anchev, PhD.

1. Brief biographical details of the candidate

Assoc. Prof. Dr. Eng. Angel Anchev was born in 1976. In the year 2000 he graduated from the Technical University of Gabrovo, specialty "Engineering and Technology for Environmental Protection". The entire work experience of the candidate was obtained at the Technical University of Gabrovo. He received his PhD degree in 2006 and the topic of his PhD thesis was "Increasing the bearing capacity and fatigue life of structural elements with cylindrical openings by means of spherical boring". In 2016, Dr. Angel Anchev received the academic position of "Associate Professor" in the Department of Technical Mechanics, which in 2021 was transformed into the Department of Materials Science and Mechanics of Materials at the Technical University of Gabrovo. Since the year 2020 Assoc. Prof. Dr. Angel Anchev is the Head of the Department of Materials Science and Mechanics of Materials.

2. Overview of the content and results in the presented papers

The total scientific production presented by the candidate consists of 109 scientific works, of which 28 published works are in journals with a high impact factor (IF), 1 publication in a journal with impact rank (SJR), 15 in the proceedings of Bulgarian and international forums, 55 articles in Bulgarian peer reviewed scientific journals, 10 developed textbooks and teaching aids for students. The remaining works are co-authored, where in 27 of them Assoc. Prof. Dr. Eng. Anchev is the first author. A list of 168 independent citations is presented. Most of the citations are in high-quality journals with a high impact factor. According to Scopus

database inquired on 27.10.2022, the total number of independent citations of the candidate is 186 and the h-index is 7. The increase in the number of independent citations since 2018 makes a very good impression, which gives me reason to think that the aforementioned data will increase further. Thus, the presented scientific metrics significantly exceed the criteria for holding the academic position of "professor", both according to the criteria of the TU-Gabrovo and according to the Law for development of the academic staff in the Republic of Bulgaria (RASRB).

Assoc. Prof. Dr. Eng. Anchev has submitted a total number of 42 scientific papers. Of these, 21 are published in international journals with a high impact factor, 1 publication is published in a journal with an impact-rank, 1 is in the proceedings of an international conference, 15 articles in Bulgarian scientific peer-reviewed journals, 4 textbooks and teaching aids for students. Of all the publications presented in the competition, 5 are standalone. The candidate has submitted the equivalent of a habilitation thesis, consisting of ten publications, which are thematically grouped in the field of improving the surface performance of specimens of single-phase and two-phase aluminum bronze, 37Cr4 structural steel and AISI 304L austenitic chromium-nickel steel using the diamond burnishing method. The documents also contain a list of project participations, information on training of undergraduate and postgraduate students, lecture courses developed, as well as courses taught by Assoc. Prof. Dr. Eng. Anchev. Convincing and sufficient evidences have been provided. Having reviewed the materials presented by the candidate, I can boldly state that he meets, even significantly exceeds, the minimum national requirements as well as those of the Technical University of Gabrovo.

3. General description of the candidate's interests

3.1. Teaching and pedagogical activities (work with students and PhD students)

Assoc. Prof. Dr. Eng. Angel Anchev is an established lecturer with nearly 20 years of scientific and teaching experience at the Technical University of Gabrovo. The teaching and pedagogical activity of the candidate is at a remarkably high level, which corresponds to the academic position "Professor". He is a leading lecturer in 6 academic courses - Layer-Building Technologies; Digital Prototyping; Technical Mechanics; Mechanics - Part I and Part II; Computer Simulations of Systems and Processes. He has developed lectures for 3 courses, as follows: Layer-Building Technologies; Information Gathering and Processing Systems; Computer Simulations of Systems and Processes. The applicant has issued 10 textbooks and teaching aids, of which 4 are included in the documents for the competition for "professor" - Guide to solving problems in dynamics; Diamond smoothing; Metal Science and Heat Treatment Part II Heat Treatment of Metals; Aluminum Alloy by Slide Burnishing. Assoc. Prof. Dr. Eng. Angel Anchev has supervised 2 PhD students and 28 graduate students.

3.2. Scientific interests

The scientific interests of Assoc. Prof. Dr. Eng. Angel Anchev are in the field of mechanics of materials. The scientific works with which Assoc. Prof. Dr. Eng. Anchev

participated in the competition for "professor" are published in journals with a high impact factor and international scientific forums.

Assoc. Prof. Dr. Eng. Angel Anchev has participated in 8 projects, including 1 financed by the Science and Education for Smart Growth Program, 1 funded by the Bulgarian National Science Fund, and 6 funded by the Science Fund of the Technical University of Gabrovo.

4. Contributions. Significance of the contributions to science and industry

The main scientific contributions of Assoc. Prof. Dr. Eng. Anchev are in the field of surface engineering and, in particular, in the surface treatment of metals and alloys using the methods of diamond burnishing and surface plastic deformation by means of a toroidal roller.

Contributions in the equivalent of a habilitation thesis are related to the improvement of the surface performance of specimens of single-phase and two-phase aluminium bronze, 37Cr4 structural steel and AISI 304L austenitic chromium-nickel steel using the diamond burnishing method. I summarized them as follows:

- The surface wear resistance characteristics and fatigue behavior of single-phase and two-phase aluminum bronze were successfully improved using the diamond burnishing method. It was found that the fatigue limit was increased by 16.7% and the fatigue life more than 77 times.
- An innovative approach has been developed to evaluate the fatigue behaviour of 37Cr4 low-alloy structural steel specimens machined by diamond burnishing. A combination of finite element analysis and experiment was used to define the constitutive material model of the surface layer of the specimens.
- It was shown that the application of the diamond burnishing to specimens of austenitic chromium-nickel steel AISI 304L leads to a significant increase in hardness and fatigue strength.
- A comparative analysis between diamond burnishing, surface plastic deformation with a toroidal roller and deep rolling on low alloy carbon steel specimens is presented. It was shown that diamond smoothing provides lower roughness, significantly higher microhardness, larger in absolute values residual compressive stresses, finer microstructure and as a result higher fatigue strength.
- A cost-effective optimization approach to increase the fatigue strength of steel specimens machined by diamond smoothing has been developed.

The contributions of the submitted works, beyond the habilitation thesis, are summarized as follows:

- Welds of pure copper and austenitic chromium-nickel steel AISI 304L have been successfully formed by an electron-beam welding technology. New knowledges about the structure and functional characteristics of the formed joints were obtained.
- Significant improvement of the surface characteristics and fatigue behavior of 2024-T3 high-strength aluminum alloy structural elements was achieved by surface plastic deformation with a toroidal roller.

- The technological parameters of the diamond burnishing process, ensuring minimum roughness, have been approximated. The beneficial microeffect of applying diamond smoothing is demonstrated, representing a delay in the time at which a micropunctate, stripped and homogenized microstructure is formed to a depth of about 0.5 mm.
- An approach has been developed to increase the crack resistance of openings in post-tensioned joints by surface plastic deformation.
- An approach has been developed to improve the fatigue behaviour of fastener openings in 2024-T3 aluminium alloy structural members by surface plastic deformation.
- An approach based on the finite element method has been developed to increase the fatigue life of 41Cr4 low alloy carbon steel specimens subjected to diamond smoothing.
- The optimum parameters in smoothing, deep or mixed burnishing processes of 41Cr4 low alloy carbon steel specimens were determined.
- A comparative analysis between the influence of fastener openings expansion methods on the fatigue life of D16AT aluminum alloy specimens is presented.
- Original, new data on the obtained roughness of specimens of low, medium carbon and tool steels subjected to diamond smoothing are determined.

The fact that the results on which the contributions are based have been published in high quality journals with a high impact factor characterizes the defined contributions as extremely significant.

5. Evaluation of the candidate's personal contribution

His published works are in reputable scientific journals and have found a sufficiently large response in the scientific literature. The high quality of the scientific production proves that Assoc. Prof. Dr. Eng. Anchev can formulate and manage the solution of scientific research problems, which is confirmed by his work with PhD students and undergraduates. For me, the personal contribution of the candidate is indisputable.

6. Critical comments and recommendations

I have no critical comments on the materials submitted for the competition for the academic post of "Professor".

7. Personal impressions

I have known Assoc. Prof. Dr. Angel Anchev for several years as a competent and dedicated colleague from the Technical University of Gabrovo. In my opinion, he is a very good scientist, with good knowledge and skills. He is an established specialist with great experience in the field of materials science and mechanics of materials. We have repeatedly commented on various topics, and he has always given extremely competent and reasoned opinions. From the many conversations we have had, it is clear that Assoc. Prof. Dr. Eng. Anchev is a leading specialist in the field in which he works.

8. Conclusion:

On the basis of the documents submitted for the competition, the contributions and the significance of the scientific works, I think that Assoc. Prof. Dr. Eng. Angel Petrov Anchev fully fills the criteria for holding the academic position of "Professor", according to the criteria of the TU-Gabrovo and according to the Law for development of the academic staff in the Republic of Bulgaria (RASRB). Taking the above into account, I give my **positive assessment** with full conviction and propose Assoc. Prof. Dr. Eng. Angel Petrov Anchev **to be elected** as "Professor" in the field of - 5. Technical Sciences, professional field of study - 5.6. Materials and Materials Science, specialty - Materials Science and Engineering Materials Technology.

07.11.2022

Member of the scientific jury: /signature/

/Assoc. Prof. Dr. Stefan Valkov/