OPINION

Assoc. Prof. Tatiana Mechkarova, PhD, Eng.

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Department of Materials Science and Mechanics of Materials
on the materials submitted for participation in a competition
for the academic position of „Associate Professor“
in the field of higher education – 5. Technical Sciences
in the professional field – 5.6. Materials Science
specialty – Materials Science and Technology of Engineering Materials.

In the competition for Associate Professor, announced in the State Gazette No. 53/09.06.2026 and on the website of TU-Gabrovo, for the needs of the Department of „Mechanical Engineering, Computer Systems and Electrical Engineering“ at the Technical College of Lovech. The candidate participating in the competition is Senior Assistant Professor Eng. **Mariana Dimitrova Ichkova Ph.D.**, Technical University of Gabrovo.

1. Overview of the Submitted Materials and Scientific Works

For participation in the competition, Chief Asst. Prof. Mariana Ichkova, PhD, Eng., has submitted a set of documents, including information on education and professional development, a list and copies of scientific works, a citation report, an author's statement of contributions, an extended habilitation report, data on teaching activities, textbooks, and participation in research projects.

The scientific research is centered around the investigation and improvement of surface plastic deformation (SPD) methods, with an emphasis on diamond burnishing, the formation of favorable stress-strain states, microstructural changes, and enhancing the fatigue life of metal components. The habilitation thesis is presented as a collection of related publications on the topic "Improving the surface properties and performance behavior of metallic components by means of SPD with sliding friction contact".

According to the submitted scientometric report, the candidate declares 34 scientific publications, of which 4 are independent, 15 publications are with an impact factor, 148 citations, and 3 textbooks. The registered scores are: 50 points for Group A, 249 points for Group B, 210 points for Group G, and 1480 points for Group D. These values exceed the minimum national thresholds for the academic position of "Associate Professor" in the respective indicator groups. The evaluation is based on the report provided by the candidate.

2. General Characteristics of the Candidate's Activity

2.1. Teaching and Pedagogical Activity

The presented data indicates teaching activity in core engineering disciplines. The candidate has delivered lectures in "Technical Mechanics", as well as laboratory and seminar exercises in "Materials Science and Technology of Machine-Building Materials", "Computer Methods for Engineering Analysis", "Strength of Materials" (Mechanics of Materials), "Applied Mechanics", "Theoretical Mechanics", and other courses

within the mechanics and materials science cycle. The inclusion of three textbooks complements this activity and demonstrates participation in educational and methodological support.

2.2. Scientific and Applied Research Activity

The scientific research is characterized by the consistent application of experimental methods, mathematical modeling, finite element simulations, and multi-criteria optimization. Structural and stainless steels, as well as non-ferrous alloys, including CuZn39Pb3 brass, have been examined. A significant feature is the effort to establish the relationship between the technological parameters of finishing, the condition of the surface layer, and the performance characteristics.

The publications utilize measurements of roughness, microhardness, and residual stresses, structural and phase analysis, as well as fatigue testing. Special attention is warranted by the research on austenitic steels, which examines the role of strain-induced martensite, and the works on 42CrMo4 and C45 aimed at increasing fatigue strength after combined treatments.

2.3. Project and Implementation Activity

From the attached project activity report, participation in national and other research initiatives is established, including the Competence Center "Intelligent Mechatronic, Eco- and Energy-Saving Systems and Technologies". The results possess potential for technological application in the finishing treatment of shafts, axles, and other critical machine elements. The submitted data should not be interpreted as evidence of specific industrial implementation beyond explicitly documented cases.

3. Contributions and Significance for Science and Practice

3.1. Scientific Contributions

The essential scientific results include clarifying the dependencies between surface plastic deformation regimes, phase and structural changes, and the formed residual stresses; analyzing the mechanical and thermal effects during diamond burnishing; and investigating the influence of prior machining on the effectiveness of subsequent surface hardening. The use of the concept of effective surface residual stress in a dual-phase surface layer of austenitic steels is of particular interest.

3.2. Scientific-Applied Contributions

Finite element and regression models have been developed and utilized for predicting surface layer characteristics, along with approaches for optimizing process control factors. The correlations of "finishing treatment – surface properties – operational behavior" have been investigated, allowing technological regimes to be selected according to requirements for roughness, hardening, wear resistance, and fatigue strength. Significant results include the development of combined and environmentally friendly processes, including dry hard turning followed by diamond burnishing.

3.3. Applied Contributions

The practical orientation is expressed in determining rational and optimal technological parameters for the processing of specific materials and parts, designing technological equipment, and accumulating experimental data on roughness, microhardness, residual stresses, and fatigue life. The obtained

relationships can support the selection of finishing treatments when designing technological processes for critical machine components.

4. Evaluation of the Candidate's Personal Contribution

A thematic continuity is observed in the submitted materials between early research on residual stresses around cold-expanded holes and more recent publications on surface integrity and performance behavior after diamond burnishing. The presence of independent publications and works where the candidate is the leading author provides a reasonable basis to accept a distinct personal contribution. In collective research, individual participation is evaluated positively within the scope of the declared author contributions, without attributing all results exclusively to the candidate.

5. Critical Remarks and Recommendations

Regarding the presented scientific results, recommendations can be made to further extend comparative studies on the long-term operational behavior of treated components under combined loads and in various environments. These recommendations do not diminish the scientific and practical value of the presented developments.

6. Personal Impressions

Based on the scientific materials, a consistency in research interests and an orientation toward practically significant engineering problems can be noted.

7. Conclusion

Based on the submitted competition materials, I positively evaluate the scientific, scientific-applied, and teaching-pedagogical activities of Chief Asst. Prof. Mariana Dimitrova Ichkova, PhD, Eng. The scientific output is thematically related to the announced competition and contains results contributing to the modeling, investigation, and optimization of surface plastic deformation processes and to improving the operational performance of metal components.

According to the submitted report, the candidate meets and exceeds the minimum national scientometric requirements for the academic position of "Associate Professor".

Given the above, I propose Asst. Prof. Mariana Dimitrova Ichkova, PhD, Eng. to take up the academic position of "Associate Professor" in Area of Higher Education - 5. Technical Sciences, Professional Field - 5.6. Material Science and Mechanics of Materials and Scientific specialty - Materials Science and Technology of Machine-Building Materials.

Date: October 31, 2026

Prepared the Statement: .....

/Assoc. Prof. Tatiana Mechkarova, PhD, Eng./