O P I N I O N

by Assoc. Prof. Eng. Borislav Tsonev Stoyanov, Ph.D., Technical University of Gabrovo, Department Industrial Engineering and Design

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 Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., Technical University of Gabrovo.

1. Review of the content and results of the submitted works

According to the submitted documentation, Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., for the competition for the position of "Associate Professor" comply with the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, and the Regulations for the Acquisition of Scientific Degrees and the Occupation of Academic Positions at the Technical University of Gabrovo.

The materials include: a dissertation for the award of the educational and scientific degree of "Doctor" (PhD); a habilitation thesis consisting of 13 related scientific publications in international journals with an Impact Factor, indexed by Web of Science; 2 refereed scientific publications; 19 publications in non-refereed journals subject to scientific peer review; 148 citations in refereed and indexed internationally recognized databases; and 2 textbooks and 1 study guide, all related to the subject matter of the competition.

The quantitative indicators of the criteria for filling the academic position "Associate Professor", according to the Regulations for the acquisition of scientific degrees and the filling of academic positions at TU-Gabrovo, are covered.

The scientific works included in the presented materials fall into the following research areas: improvement of the surface properties and operational performance of metal components through surface plastic deformation (SPD); technological methods for enhancing the fatigue life of structural elements containing fastener holes; and

experimental and simulation-based investigation of the mechanical characteristics and behavior of metals and alloys.

In the first group, an integrated classification of static surface plastic deformation (SPD) methods was developed. The application of slide burnishing (SB) using a spherical diamond-tipped deforming tool on various materials was investigated. The influence of process parameters on the temperature field, residual stresses, axial force, fatigue limit, microstructure, surface roughness characteristics, and surface microhardness was determined. Planned experiments were conducted, with key process parameters serving as the control factors. The effect of SB on roughness parameters - specifically Ra, Rsk, and Rku—was established. Additionally, residual stresses within the dual-phase structure of the surface layer were measured following the SPD process.

The second group includes: Finite element (FE) models have been developed for various surface enhancement methods - specifically, spherical burnishing of a cracked hole, the "StressWave" method, and conventional cold expansion (CE) of circular and non-circular holes using a cylindrical mandrel. The study examined how various tool geometric parameters influence the resulting residual compressive stress field and the required axial force. Additionally, an approach was investigated for enhancing the fatigue life of structural steel components featuring non-circular holes with rounded corners. Regression models were also derived to quantify the degree of strain hardening around holes subjected to finishing via spherical burnishing.

The third group includes: Constitutive models incorporating isotropic, linear kinematic, and non-linear kinematic hardening have been developed for 2D and 3D stress states. Furthermore, the influence of heat treatment temperatures, as well as the impact of specific alloying elements, on the mechanical properties of certain die steels has been investigated.

2. General characteristics of the candidate's activities

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

According to the submitted documentation, Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., has delivered lectures in one subject, and conducted laboratory and seminar exercises in 11 subjects included in the curricula for Bachelor’s and Master’s degree programs within the Faculty of Mechanical and Precision Engineering, and Faculty of Electrical Engineering and Electronics, at the Technical University of Gabrovo.

2.2. Scientific and research activities

The candidate, Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., has participated in 3 national research projects funded through European programs, 18

projects funded by the national budget (with the Technical University of Gabrovo as the beneficiary), and 3 educational projects.

2.3. Implementation activity

According to the submitted documentation for participation in the competition for the academic position of Associate Professor contains no evidence of implementation activities by the candidate.

2.4. Other activity

According to the submitted documentation, Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., has been actively involved in the maintenance and modernization of classrooms and computer laboratories; she works in the "Metal Testing" laboratory, serves as a technical editor for the Journal of the Technical University of Gabrovo, develops online tests for university entrance examinations in general technical subjects, and participates in committees responsible for organizing and conducting examinations, as well as grading examination papers.

3. Contributions (scientific, applied-research, practical) and their significance for science and practice

The contributions presented in the summary of the author's work are clearly formulated, methodologically well-argued, encompassing both scientific-applied and applied results.

The scientific-applied contributions relate to: the development of finite-element models for metal-working processes and mechanical systems; the development of efficient combined, hybrid, and eco-friendly processes for improving the surface properties and operational performance of metal components; the establishment of correlations between "finishing - surface properties - operational performance" in the context of surface plastic deformation (SPD); the development of classification schemes for SPD methods and processes; the development of mathematical models for the geometric and mechanical characteristics of the surface layer of metal components processed via SPD; the development of constitutive models describing the material behaviour of the surface layers of metal components subjected to SPD; the establishment of a correlation between technological heredity and the capability of the SPD process to enhance the surface properties and operational performance of metal components; the investigation of the correlation between technological parameters and deformation-induced α'-martensite during the SPD of chromium-nickel austenitic steels; the development of mathematical models for strain hardening and creep behaviour of the material surrounding cold-expanded holes in non-ferrous alloys; and the development of mathematical models for the energy and force characteristics of SPD processes. The energy balance within the thermodynamic system comprising the "deforming element"

and the "workpiece surface" during the Surface Plastic Deformation (SPD) process - involving sliding contact friction - has been investigated. Mathematical models for the strain hardening of tough-plastic alloys have been developed, as have models describing the mechanical characteristics of die steels.

The practical contributions include the creation of a database containing optimal values for the control factors of the SPD process, which ensure minimal surface roughness, maximum microhardness, and compressive residual stresses. Furthermore, specialized technological tooling has been developed for the implementation of SPD processes.

I accept the formulation of the contributions as presented by Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., as well as their number, deeming them significant and relevant to the subject of the competition.

4. Evaluation of the candidate's personal contributions

From the materials submitted for the competition the candidate has authored 4 independent scientific works, 8 works in which she is the first author, and a total of 15 works published in international journals indexed in SCOPUS and WoS - all of which significantly exceed the requirements for participation in the competition. These data lead me to conclude that the candidate demonstrates exceptional dedication and independence in her research, serving as evidence of her competence and personal contribution.

5. Critical remarks and recommendations

Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., scientific work is consistent and methodologically prepared. For her future development, strengthening international collaboration is recommended. Expanding the experimental infrastructure and establishing interdisciplinary projects would further enhance the visibility and practical significance of her research, while also contributing to her further consolidation as a specialist in the field.

6. Personal impressions

I have known Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., for approximately twenty years, and my impressions of her are exceptionally positive. She is a highly responsible, motivated, and goal-oriented professional who approaches both the teaching process and her scientific research with consistency and dedication. She treats her colleagues and students with fairness and respect, and demonstrates initiative, a strong team spirit, and a drive for continuous improvement. Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D., is a composed and reliable individual upon whom one can depend for the execution of professional and academic tasks.

7.Conclusion

Based on the scientific works submitted, I support and recommend that Senior Assist. Prof. Eng. Mariana Dimitrova Ichkova, Ph.D. to be appointed to the academic position of Associate Professor in the
field of Higher Education – 5. Technical Sciences,
Professional Field – 5.6. Materials Science,
specialty – Materials Science and Technology of Engineering Materials.

Gabrovo
28.10.2026

Member of the Scientific Jury: ……
/ Assoc. Prof. Eng. Borislav Stoyanov, Ph.D./