**R E V I E W**

**by Assoc. Prof. Vladimir Petrov Dunchev, PhD, Eng.**

**on the materials submitted for participation in a competition for the academic position of "Associate Professor"**

**in Higher Education Area 5. Technical Sciences,**

**Professional Field 5.6. Materials and Materials Science,**

**Specialty: 5.6. Materials Science and Technology of Mechanical Engineering Materials**

n the competition for Associate Professor, announced in the State Gazette, issue 53/09.06.2026, and on the website of the Technical University of Gabrovo for the needs of the Department of Mechanical Engineering, Computer Systems, and Electrical Engineering at the "TK-Lovech" Technical College, the sole candidate participating is Chief Assistant Professor Mariana Dimitrova Ichkova, PhD, Eng.

## 1. Brief Biographical Data

Chief Assistant Professor Mariana Dimitrova Ichkova, PhD, Eng., acquired the educational and scientific degree "Doctor" (PhD) in 2009, awarded in the scientific specialty 01.02.02 "Applied Mechanics" after defending a dissertation thesis on the topic: *"Study of the Residual Macrostress Field Around Cold-Expanded Holes in Low and Medium Carbon Steels"*. Dr. Ichkova has built her academic and research career at the Technical University of Gabrovo as a Chief Assistant Professor, accumulating many years of teaching and research experience in mechanics, materials science, materials processing, surface plastic deformation (SPD), and computer modeling of engineering processes.

## 2. General Description of the Submitted Materials

The candidate participates in the competition with the following research studies and teaching materials:

- ✓ **Indicator A**: Diploma for the educational and scientific degree "Doctor" (PhD) issued by the Supreme Attestation Commission (SAC) in the scientific specialty 01.02.02 "Applied Mechanics" on the topic *"Study of the Residual Macrostress Field Around Cold-Expanded Holes in Low and Medium Carbon Steels"* – **50 points**;
- ✓ Habilitation Work **(Indicator B)**: 13 scientific publications are presented, grouped under the general habilitation theme: *"Improving the Surface Properties and Operational Performance of Metallic Components via SPD with Sliding Friction Contact"*. All publications are referenced and indexed in world-renowned scientific databases (Web of Science / Scopus), nine of which have an Impact Factor, and the rest have an SJR and are distributed across quartiles (Q1, Q2, Q3, Q4). It is noteworthy that Dr. Ichkova is the first author in four of the presented scientific publications and the sole author in one. With a requirement of 100 points and 10 related scientific publications in international scientific journals, Dr. Ichkova participates with 249 points and 13 scientific publications, which significantly exceeds the minimum national requirements for participating in a competition for the academic position of "Associate Professor" in Higher Education Area 5. Technical Sciences;

✓ Scientific Publications Outside the Habilitation Work (**Indicator G**): Includes 21 scientific papers, including 2 articles in indexed international journals (Quartile Q1), with Dr. Ichkova as the first author of one of the publications. The remaining 19 scientific publications are in non-refereed peer-reviewed journals. Dr. Ichkova is the first author in seven of them and the sole author in three. With a requirement of 200 points under Indicator G, Dr. Ichkova's score is 210 points.

✓ Citations (**Indicator D**): A report of 148 known citations of the candidate's scientific works in international refereed journals indexed in Web of Science and Scopus, as well as in monographs, edited volumes, and non-refereed peer-reviewed journals, is presented. Remarkably, under Indicator D, the candidate participates with more than 20 times the required points, totaling 1,480 points.

✓ Educational Publications: Dr. Ichkova is the co-author of 2 university textbooks and 1 teaching aid.

The compliance report regarding the minimum national requirements and those of TU–Gabrovo shows that the candidate meets and exceeds the required number of points for the academic position of "Associate Professor":

**Group A:** 50 pts. (required: 50 pts.);

**Group B:** 249 pts. (required: 100 pts. from the habilitation monograph set);

**Group G:** 210 pts. (required: 200 pts.);

**Group D:** 1480 pts. (required: 50 pts.).

**3. Reflection of the Candidate's Scientific Publications in the Scientific Community (Known Citations)**

Dr. Ichkova's scientific publications have been widely cited in international and national scientific databases. Her works related to diamond burnishing (DB) processes, finite element simulations, fatigue life, and microstructural transformations have been cited a total of 148 times in refereed and indexed publications in the world-renowned Web of Science and Scopus databases, earning a total of 1,480 points under Group D.
Among her most cited works are:

- The review article related to SPD processes with sliding friction contact: *"Slide burnishing - review and prospects"*, published in the prestigious journal *International Journal of Advanced Manufacturing Technology* (Springer, IF 2.633, Q1), with **75 citations**;
- The study on the modeling of strain hardening and creep behavior of aluminum alloys: *"Modeling of strain hardening and creep behaviour of 2024-T3 aluminium alloy at room and high temperatures"* in *Computational Materials Science* (Elsevier, IF 2.131, Q1), with **59 citations**;
- A series of works dedicated to improving Surface Integrity (SI) and fatigue life through DB of structural steels and non-ferrous alloys, published in reputable journals by Springer (*Journal of the Brazilian Society of Mechanical Sciences and Engineering*, IF 2.220, Q2) and MDPI (*Metals*, IF 3.1, Q2; *Machines*, IF 3.0, Q2; *Applied Sciences*, IF 2.9, Q2; *Journal of Manufacturing and Materials Processing*, IF 4.0, Q1).

The numerous citations in reputable high-IF and high-quartile (Q1 and Q2) journals published by leading global publishers (Springer, Elsevier, MDPI, etc.) clearly demonstrate the significance and

relevance of the scientific and applied research results achieved by Dr. Ichkova in the field of materials science, specifically SPD processes and finite element simulations.

**4. Overview of Content and Results in the Submitted Works**

The main scientific direction in Dr. Mariana Ichkova's work is the study and optimization of SPD processes with sliding friction contact (Slide Burnishing / Diamond Burnishing).

The highlights of the presented habilitation work and accompanying publications include:

*1. Systematization and Classification: Application of the differential-morphological decomposition method, definition of element values, and construction of a morphological matrix to systemize and synthesize new schemes and methods for SPD with sliding friction contact;*

*2. Thermomechanical and Constitutive Modeling: Definition of mathematical and finite element models accounting for non-linear kinematic/isotropic hardening, cyclic hardening, temperature fields, and the balance between strain hardening and thermal softening effects in the contact zone;*

*3. Ecological and Combined Technologies: Development and experimental validation of environmentally friendly (green) combined hybrid processes integrating dry turning and dry DB, as well as turning and DB with vortex tube cold air cooling, which are cost-effective and safe for human health;*

*4. Surface Integrity (SI) and Fatigue Life: In-depth analysis of the impact of SPD on microstructure, phase composition (including deformation-induced $\alpha'$-martensite in austenitic steels), compressive residual stresses, microhardness, and roughness across various structural steels (41Cr4, 42CrMo4, C45, AISI 304) and non-ferrous alloys (CuZn39Pb3, Al 2024-T3).*

**5. General Characteristics of the Candidate's Activity**

**5.1. Educational and Pedagogical Activity** (Work with Students and PhD Students)

Chief Assistant Professor Mariana Ichkova, PhD, Eng., has an established teaching profile. She delivers lecture courses in "Technical Mechanics" and conducts laboratory sessions in the Department of Materials Science and Mechanics of Materials covering core engineering subjects. She is a co-author of two university textbooks: "Computer Methods for Engineering Analysis, Book 1: Linear Statics of Beam Structures" and "Specialized (Non-standard) Processing Methods and Tools", as well as a study aid: "Specialized (Non-standard) Processing Methods and Tools – Syllabus and Test Questions".

**5.2. Scientific and Applied Scientific Activity**

The candidate's research activity is characterized by high intensity in recent years and high quality of published results. The candidate actively participates in national and university research projects and collaborates with research teams inside and outside TU–Gabrovo, as evidenced by joint publications in reputable international journals indexed in Web of Science and Scopus.

**5.3. Implementation Activity**

The candidate has not submitted official implementation documents or patent documentation. On the other hand, the applied scientific and practical results obtained by Dr. Ichkova (created

databases with optimal parameters, developed designs of deforming tools with PCD and Ferro-TiC indenters) have clear practical value and real potential for direct implementation in mechanical engineering.

**6. Contributions** (Scientific, Applied Scientific, Practical).

I accept the contributions formulated by the candidate, which can be summarized into the following main groups:

***Applied Scientific Contributions:***

*1. Developed and verified finite element and constitutive models of metalworking processes with SPD, accounting for non-linear material behavior, kinematic hardening, and thermomechanical phenomena in the contact zone;*

*2. Developed effective, combined, and environmentally sustainable (hybrid) machining processes (dry turning + dry DB or dry turning + DB with cold air cooling);*

*3. Established "finishing – surface properties – operational performance" correlations for a wide range of structural materials in SPD processes;*

*4. Investigated the influence of technological heredity (cutting tool wear during prior turning) on the capacity of subsequent DB to improve surface layer quality in C45 steel;*

*5. Established the correlation between SPD parameters and deformation-induced phase transformation ($\gamma \rightarrow \alpha'$-martensite) in the surface layer of AISI 304 chromium-nickel austenitic steel;*

*6. Systematized and classified methods for SPD with sliding friction contact based on the differential-morphological method.*

***Practical Contributions:***

*1. Created an extensive database of optimal values for SPD process parameters ensuring minimum roughness, maximum microhardness, and favorable compressive residual stresses;*

*2. Designed and tested specialized tooling equipment and deforming tools (including deforming elements made of PCD and Ferro-TiC) for executing SPD processes.*

**7. Assessment of the Candidate's Personal Contribution**

I am personally acquainted with the research and academic activities of Chief Assistant Professor Mariana Ichkova, PhD, Eng. The materials submitted for the competition confirm her active role in the research team of the Department of Materials Science and Mechanics of Materials during the implementation of applied and practical studies.

Out of the total research summary of 34 scientific publications, she is the sole author in 4 publications (articles B.6.3, G.8.10, G.8.18, and G.8.20). Dr. Ichkova is the first author in 12 publications (including 4 articles in refereed international journals under Indicator B and 8 papers under Indicator G).

Additionally, her active teaching and pedagogical participation as a co-author of 2 university textbooks and 1 study aid should be noted.

All of this gives me full reason to confirm that the formulated scientific-applied and practical contributions are the candidate's personal work or were achieved with her primary participation.

**8. Critical Remarks and Recommendations**

The submitted materials are prepared precisely and in accordance with all requirements. As recommendations for the candidate's future research activity, I would suggest:

1) Continuing her work in research projects and focusing efforts toward supervising PhD students in her field;

2) Seeking opportunities for practical implementation of the original designs of deforming tools and eco-friendly SPD technologies.

**9. Personal Impressions**

I have excellent personal impressions of Dr. Ichkova. She demonstrates professionalism, precision, and a responsible attitude toward her teaching duties. She enjoys high standing among students at the Technical University of Gabrovo.

**10. Conclusion:**

In view of the above, I recommend that Chief Assistant Professor Mariana Dimitrova Ichkova, PhD, Eng., be selected for the academic position of "**Associate Professor**" in
Higher Education Area: 5. Technical Sciences,
Professional Field: 5.6. Materials and Materials Science,
Specialty: 5.6. Materials Science and Technology of Mechanical Engineering Materials

**Date:** 20.10.2026 Reviewer:

**/Assoc. Prof. Vl. Dunchev, PhD/**