REVIEW

by Prof. Galina Ivanova Nikolcheva, PhD, Eng., Technical University of Sofia

of the materials submitted for participation in the competition
for the academic position of Associate Professor at the Technical University of Gabrovo,
Field of Higher Education 5: Technical Sciences,
Professional Field 5.1: Mechanical Engineering,
Specialty: Manufacturing Technology

The competition for the academic position of Associate Professor was announced in the State Gazette, issue No. 53 of 9 June 2026, and on the website of the Technical University of Gabrovo, for the needs of the Department of Industrial Technologies and Design at the Faculty of Mechanical Engineering and Instrument Engineering. The sole candidate is Assistant Professor Kalin Vladimirov Atanasov, PhD, Eng.

1. Brief biographical information

Based on the materials submitted for my review concerning Assistant Professor Kalin Atanasov, who is participating in the competition for the academic position of Associate Professor in professional field 5.1, Mechanical Engineering, specialty Manufacturing Technology, I have familiarised myself thoroughly with the candidate's academic, scientific and personal development. The materials show that he is the sole candidate. Assistant Professor Kalin Atanasov, PhD, Eng., graduated with a bachelor's degree in Mechanical Engineering and Technology from the Technical University of Gabrovo in 2006 and completed a master's degree in the same programme at the university in 2008. In 2016, the candidate successfully defended his doctoral dissertation in the specialty "Machining of Materials and Cutting Tools" within professional field 5.1, Mechanical Engineering, at the Technical University of Gabrovo.

Dr Atanasov began his academic career in 2020 as a member of the Department of Mechanical Engineering and Technologies at the Technical University of Gabrovo. In 2024, he won a competition for the academic position of Assistant Professor in the same department. He currently holds a position in the Department of Industrial Technologies and Design.

2. General description of the submitted materials

A total of 28 scientific publications and two teaching aids have been submitted for review. In my opinion, they meet the relevant minimum requirements. The materials are distributed among the assessment indicators as follows:

- Indicator "A" (50 out of 50 points): 8 publications have been submitted, 3 of which are single-authored;
- Indicator "B": 14 scientific publications, co-authored, with the candidate listed first in one of them. The publications are thematically related and collectively equivalent to a habilitation thesis. All have appeared in international scientific journals. Of the 14 publications, 12 have an Impact Factor (IF) and fall within the Q1 quartile (indexed in WoS and Scopus), while 2 are indexed in Scopus with an SJR value. These publications yield 199.5 points, compared with the 100 points required by the minimum criteria for the academic position of Associate Professor.

- 14 publications under Indicator “G”, of which:
  - 1 is abstracted and indexed in Scopus (Indicator “G.7”);
- 13 have appeared in non-indexed but peer-reviewed publications (Indicator “G.8”). Five are co-authored, with the candidate listed first in three of them, while eight are single-authored.

  The total score under Indicator “G” is 214.6 points, compared with the 200 points required by the minimum criteria for the academic position of Associate Professor.
- 45 citations under Indicator “D”, of which:
  - 43 citations are in scientific publications abstracted and indexed in internationally recognised databases;
  - 2 citations are in non-indexed, peer-reviewed scientific journals.

  The total score under Indicator “D” is 454 points, compared with the 50 points required by the minimum criteria.

The scientific works submitted by the candidate for this competition for the academic position of Associate Professor are not included in the list of publications related to his doctoral dissertation.

The materials submitted for the competition meet the requirements regarding volume and structure. Their content fully corresponds to the subject area of the competition and fulfils the requirements for appointment to the academic position of Associate Professor.

3. Impact of the candidate’s scientific publications on the research community (citations)

The 14 scientific works submitted under Indicator B have been published in reputable international scientific journals with an Impact Factor indexed in Web of Science; two are indexed in Scopus. Six of these 14 works have received a substantial number of citations (45 in total).

The citations demonstrate the strong interest of the international research community in the candidate’s publications, as well as their significance. In the 2026 ranking, Assistant Professor Kalin Atanasov, PhD, Eng., has an h-index of 4, which is evidence of the impact of his publications.

4. Overview of the content and results of the submitted works

A total of 28 scientific publications have been submitted for review, 14 of which (B.4.1 to B.4.14) are thematically related and collectively equivalent to a habilitation thesis. Publications G.8.2, G.8.5 and G.8.12 address the same subject area. All these works examine various aspects of surface integrity (SI). Surface integrity affects the strength, wear resistance, fatigue performance, corrosion resistance and service life of a component.

The works are divided into three groups. The first group (B.4.1, B.4.2, B.4.3, B.4.4, B.4.8, B.4.11, B.4.12, B.4.14 and G.8.2) focuses on the design and investigation of combined, hybrid and sustainable plastic-deformation processes intended to improve surface integrity and increase the fatigue strength and fatigue life of metal components. The research centres on correlations between fatigue behaviour and key SI characteristics—surface roughness, residual stresses, microhardness and microstructure—which correspond to specific combinations of the main and additional process parameters. The experimental studies include preliminary and planned experiments, regression

analysis, X-ray diffraction analysis and rotating-bending fatigue tests. A series of Wöhler curves was obtained to predict fatigue behaviour in relation to the parameters of the investigated processes. The studies were conducted on various metallic materials, including austenitic stainless steels, structural steels and leaded brass.

The second group of scientific works (B.4.5, B.4.6, B.4.7, B.4.10 and B.4.13) investigates technological inheritance between cutting and surface plastic deformation (SPD), the correlations between these processes, and their effects on fatigue strength, fatigue life and key surface-integrity characteristics of the surface layers of metal components. The studies examine the influence of cutting conditions and tool wear on the SI of a machined surface after turning followed by diamond burnishing. As in the first group, the experimental work includes preliminary and planned experiments, regression analysis, X-ray diffraction analysis and rotating-bending fatigue tests. The materials investigated include structural steels and leaded brass.

The third group (B.4.9, G.8.5 and G.8.12) examines the influence of tool material on SI in combined plastic-deformation processes. It evaluates surface plastic deformation (SPD) processes using a deforming element made of the cermet alloy “Ferro-Tic Grade C”. The studies used a deforming element with a cylindrical end and no diamond, with the aim of improving the roughness of components made of CuZn39Pb3 alloy. A full factorial design, analysis of variance and regression analysis were used. It was established that Ferro-Tic Grade C cermet can successfully be used to manufacture deforming elements for polishing processes when the workpiece material is a copper-based alloy.

The scientific works G.8.1, G.8.3 and G.8.6 investigate sustainable and conventional cutting processes and their effects on the surface integrity of machined surfaces. They present the results of a comprehensive study of roughness obtained when turning specimens made of low-alloy steel 42CrMo4, grade 45 steel following prior heat treatment (normalising, hardening and high-temperature tempering), and leaded brass CuZn39Pb3. The influence of cutting parameters was studied under different cooling conditions: cutting fluid, dry cutting, compressed air and cooling generated by a vortex tube.

Two further scientific works (G.7.1 and G.8.10) examine technological processes and equipment for high-pressure die casting of aluminium and zinc alloys. Six additional works are presented: G.8.4, G.8.7, G.8.8, G.8.9, G.8.11 and G.8.13. Work G.8.4 analyses the stability of the technological process used to manufacture aluminium castings with threaded surfaces by high-pressure die casting. Work G.8.7 investigates resistance to intergranular corrosion. Work G.8.8 presents results concerning the roughness and microhardness of laser-treated surfaces on test specimens made of high-speed tool steel 1.3343 after conventional heat treatment—hardening and three tempering cycles—and mechanical grinding. Work G.8.11 analyses the technological capabilities of CNC machine tools to ensure consistent machined-surface characteristics when turning profiled surfaces. The final publication, G.8.13, describes an additive-manufacturing process for producing an insert-type component with complex conformal cooling channels.

5. General assessment of the candidate’s activities

5.1. Teaching activity (work with students)

Assistant Professor Kalin Vladimirov Atanasov, PhD, Eng., began his teaching career in 2020 in the Department of Mechanical Engineering and Technologies at the Faculty of Mechanical Engineering and Instrument Engineering of the Technical University of Gabrovo. During this period, he has taught courses in the following subjects:

- “Tooling and Machines”;

- “Specialised (Non-standard) Machining Methods and Tools”;
- “Non-conventional Technologies in Mechanical Engineering”;
- “Technologies and Equipment for Processing Non-metallic Materials”;
- “Metal-cutting Tools” — course project;
- “Powder Metallurgy”;
- “Electrophysical and Electrochemical Machining Methods”;
- “Non-conventional Methods of Material Processing”.
- He has also delivered lectures and practical classes in “Design of Tooling for Injection Moulding” in the master’s programme.

This gives me grounds to consider that the candidate has sufficient teaching experience and the potential to hold the position of Associate Professor.

5.2. Research and applied research activity

The candidate, Assistant Professor Kalin Vladimirov Atanasov, PhD, Eng., has participated in a number of research projects. He has taken part in a national project funded by the Operational Programme “Science and Education for Smart Growth”, BG16RFPR002-1.014-0005-C01, Competence Centre “Intelligent Mechatronic, Eco- and Energy-saving Systems and Technologies”, as well as in four research projects funded by the university’s Research Fund:

1. “Surface hardening of rotating specimens made of medium-carbon structural steel by electron-beam treatment”;
2. “Influence of the type of tangential contact in SPD with a toroidal deforming roller on the tribological behaviour of austenitic stainless steel”;
3. “Innovative Technologies and Tooling in Mechanical Engineering”;
4. “New Tools and Technologies in Mechanical Engineering”.

5.3. Implementation and industrial application

The candidate, Assistant Professor Kalin Atanasov, has substantial experience in implementing research results in industry. Under his supervision, sustainable heat-treatment processes for tool and structural steels were introduced at ARMAKO INDUSTRIES in Lyaskovets. The same company also implemented a process for manufacturing injection-mould tooling components from additively manufactured blanks, as well as a process for industrial-scale production of parts using Metal Injection Moulding (MIM) technology.

At Easy Plast BG Ltd. in Gabrovo, under the supervision of Dr Kalin Atanasov, a process for restoring tooling by laser cladding of tool steels and a process for laser welding polymer components were implemented.

6. Contributions (scientific-applied and applied)

I acknowledge the contributions presented by the candidate, Assistant Professor Kalin Atanasov, but they are described in excessive detail. I have therefore summarised them without diminishing their scientific value.

Scientific - applied contributions

1. New, improved and experimentally validated methods and technological approaches have been developed for surface plastic deformation (SPD) of external cylindrical surfaces by slide roller burnishing (SRB) using a toroidal deforming element, as well as several innovative variants of diamond burnishing (DB). These methods significantly improve the quality and functional

characteristics of the surface layer and reduce the roughness of machined surfaces [B.4.1, B.4.2, B.4.3, B.4.4, B.4.12, B.4.14, G.8.2].

2. The patterns and mechanisms governing the formation of surface integrity during diamond burnishing (DB), roller burnishing (RB) and slide roller burnishing (SRB) have been established, including the effects of process parameters on roughness, microhardness, residual stresses, structural changes and phase transformations in the surface layer. The developed diamond-burnishing processes reduce roughness to mirror-like levels, increase microhardness and generate beneficial compressive residual stresses, thereby improving wear resistance and tribological properties [B.4.1, B.4.2, B.4.3, B.4.8, B.4.12, B.4.14].

3. New sustainable and combined finishing processes have been developed and substantiated. They combine turning and DB under different machining conditions without cutting fluid (dry machining, cold air and nitrogen), with the aim of maintaining or improving surface integrity and reducing environmental impact [B.4.6, B.4.7, B.4.10, B.4.13].

4. Correlations have been established between process parameters, surface integrity and component performance, including wear resistance and fatigue strength in various steels and non-ferrous alloys. The influence of cutting-tool wear during preliminary turning, followed by diamond SPD, on subsequent surface deformation and the in-service behaviour of components has been substantiated [B.4.4, B.4.5, B.4.6, B.4.7, B.4.10, B.4.13].

5. Mathematical models and multi-criteria approaches for process optimisation have been developed, including mathematical modelling of strain-induced martensitic transformation and multi-objective optimisation of SPD processes to achieve the required surface-layer characteristics and service properties of components [B.4.4, B.4.5, B.4.6, B.4.9].

Applied contributions

1. Experiments have demonstrated that, when machining AISI 316 steel, SRB reduces roughness to Ra = 0.068–0.080 μm, whereas the conventional roller burnishing (RB) method produces Ra = 0.117–0.163 μm. This represents an approximately twofold improvement in surface quality [B.4.1].

2. The developed diamond-burnishing (DB) processes for AISI 316 steel, under different machining conditions (lubricated, dry, with cold air and with nitrogen), achieve roughness values of Ra = 0.041–0.049 μm while also producing compressive residual stresses to a depth exceeding 0.5 mm [B.4.3].

3. Three optimised combined processes involving sequential turning and DB, with lubrication, dry machining, cold air and nitrogen cooling, improve surface quality. When machining AISI 316 steel, mirror-like smoothness of approximately Ra = 0.041 μm was achieved. For CuZn39Pb3 brass, the minimum roughness values obtained with abundant lubrication, dry machining and dry machining with cold air were Ra = 0.054 μm, 0.079 μm and 0.082 μm, respectively, under the different sustainable machining conditions [B.4.3, B.4.7].

4. A significant increase in fatigue strength and service life has been demonstrated for machine components made of heat-treated 42CrMo9 steel. The combined “turning + DB” process increases the fatigue limit by 20 MPa, while fatigue life increases more than 70-fold compared with dry turning. For C45 steel, a fatigue limit of up to 741 MPa was achieved; for 42CrMo9 steel, RB increased the fatigue limit from 390 MPa to 440 MPa [B.4.5, B.4.10, B.4.14].

5. Practical recommendations have been developed for selecting and optimising turning and SPD conditions. Quantitative relationships have been established between process factors and

surface-layer quality parameters, enabling technological results to be controlled and predicted under production conditions [B.4.5, B.4.6, B.4.7].

6. The technological possibilities for machining additively manufactured components have been expanded by combining heat treatment and diamond burnishing to improve the mechanical properties and surface integrity of 17-4PH steel. For additively manufactured 17-4PH steel, residual stresses of 1426.3 MPa (axial) and 1095.9 MPa (circumferential) were obtained. These results contribute to improved physical and mechanical properties and surface quality of components produced by additive manufacturing [B.4.11].

7. A technology combining laser cladding and subsequent nitriding has been developed to restore worn working surfaces of tooling made of 1.2343 steel. The die exhibited an approximately 50% increase in microhardness compared with the base material [G.7.1, G.8.10].

7. Assessment of the candidate's individual contribution

The candidate has not submitted contribution statements specifying the individual contributions to co-authored works; therefore, I regard the co-authors' contributions as equal. The candidate has eight single-authored publications. These facts give me grounds to conclude that Assistant Professor Kalin Vladimirov Atanasov has made an equal contribution to the submitted co-authored works and that his individual contribution is substantial.

8. Critical comments and recommendations

I have no critical comments on the submitted materials. I recommend that the candidate continue his work and publish in reputable journals.

9. Personal impressions

I do not know the candidate's personal qualities in depth. Based on my brief personal contact with Assistant Professor Kalin Atanasov, PhD, Eng., I have formed the impression that he is an intelligent and ambitious lecturer with excellent practical knowledge. I believe that he has the qualities and potential to contribute to raising the scientific level of the teaching staff in the Department of Industrial Technologies and Design.

10. Conclusion

In my opinion, the materials submitted for the competition are very well prepared and comply with all the requirements of the Regulations for the Acquisition of Scientific Degrees and Academic Positions at the Technical University of Gabrovo. All required documents and supporting information have been provided. The research has been conducted to a very good standard. The submitted scientific works are relevant, their contributions are significant, and the candidate's teaching and research activities are very good.

In view of the above, I recommend that

Assistant Professor Kalin Vladimirov Atanasov, PhD

be elected to the academic position of Associate Professor in
Field of Higher Education 5: Technical Sciences,
Professional Field 5.1: Mechanical Engineering,
Specialty: Manufacturing Technology.

26 October 2026 Reviewer: Prof. Galina Nikolcheva, PhD

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