REVIEW

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on materials submitted for participation in the competition for the occupation of the academic position – "Associate Professor" in the area of higher education - 5. Technical Sciences, professional field - 5.1. Mechanical Engineering, Specialty - Industrial Heat Engineering

The competition for associate professor for the needs of the Department of Power Engineering at the Faculty of Mechanical and Precision Engineering of the Technical University of Gabrovo has been announced in the State Gazette, No. 58/23.07.2019, on the website of the University and section "Competitions" of the Register of academic staff and dissertations of the National Centre for Information and Documentation NACID.

The only one candidate in the competition is an Assistant Professor. Dr. Valentin Metodiev Petkov.

1. Biographical and professional data for the candidate

For participation in the competition Assistant Professor Valentin Metodiev Petkov has submitted documents.

All documents are submitted on time and are related to the Law on Academic Staff Development in the Republic of Bulgaria, the rules for its application and the Rules for Finding Academic Degrees and Occupation of Academic Positions at the Technical University of Gabrovo.

Dr. Petkov graduated from the Technical University of Gabrovo in 1987 with a Master's Degree in "Technology of Machine-Building and Metal-Cutting Machines".

In 2003, he defended a thesis on the "Intensificaton of heat transfer in circular tubes with rolled turbulators and spiral strips" and he received a "Doctor" degree in scientific specialty "Industrial Heat Engineering" by the HAC in the field of "Energy Technologies and Machines".

Since 1987 he was teaching at the Technical University of Gabrovo.

2. Characteristics of the publishing activity of the candidate.

The candidate submitted 25 scientific publications and 1 monograph for the competition. The correspondence of the publications with the minimum requirements for occupation of

Academic Position “Associate Professor” in the scientific area 5. Technical Sciences is shown in the table below:

Group of indicators	Content	Requirement	Execution
A	Indicator 1	50	50
B	Indicator 3	100	100
G	Sum of indicators from 5 to 11	200	239
D	Sum of indicators from 12 to 15	50	138

The table shows that the production of the candidate complies with the minimum requirements predicted in the Law on Academic Staff Development in the Republic of Bulgaria. I accept that all scientific papers are relevant to this competition. 22 of the scientific papers are articles in scientific journals (19 of them in English) and the other 3 are papers in scientific conferences of TU Gabrovo. Three of the articles in scientific journals (Journal of Enhanced Heat Transfer - 2 and International Journal of Thermal Sciences - 1) are indexed in the Scopus and WoS databases. 7 of the articles have been published in my opinion in a respectable and promising journal such as International Review of Chemical Engineering, indexed in CSA/CIG and EBSCO databases.

The publications of the candidate have been reflected in a significant number of positive citations. The three publications in journals indexed in Scopus and WoS were mainly cited, with 26 citations in the journals indexed in the same databases. An excellent impression makes the fact that some of the publications in the aforementioned journal International Review of Chemical Engineering, although not indexed in the two major databases, are cited in the journals included in these databases. As a result, the execution of the group of indicators “D” significantly exceeds the minimum requirements. In 5 publications the candidate is a single author and in 9 of the publications he is a first author. The latter gives me a reason to believe that in most cases, Dr. Petkov is the initiator or active participant in the research and analysis. There are no separation protocols submitted by the co-authors in the collective work and therefore I believe that everyone's participation is equal.

The monograph presented “Performance Evaluation of Ducts with Non-Circular Shapes and Laminar Fully Developed Flow” summarize five authors investigations published with co-authors in scientific journals outside the Scopus and WoS databases. I accept that it formally answer of the definition of a monograph and is sufficient to cover the minimum requirements for group of indicator "B". However, the inconsistencies and unequal values of

indicators B3 and B4 are obvious, which is a weakness of the Rules, used with full justification by the candidate.

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

In general, the scientific works of the candidate are focused on the intensification of heat transfer in heat exchangers and solar collectors. They include: characteristics for efficiency for deep corrugated tube with inserts; evaluation of the efficiency of non-circular cross-section channels; application of vector analysis of dimensions at low values of Reynolds numbers; heat transfer and pressure drop at transient flow in smooth tubes; estimation of turbulent flows in channels with a dendrite structure; efficiency of solar collectors. Especially good impression makes the critical analysis of the benefits of using intensified heat exchange surfaces in the design of heat exchangers.

4. Basic scientific and applied scientific contributions.

4.1 Contributions in the Monograph "Performance evaluation of ducts with non-circular shapes and laminar fully developed flow".

I evaluate the contributions in the monograph as scientifically applied, reduced to obtaining and proving new and confirmatory facts. The energy characteristics of fully developed laminar flows in heat exchangers with non-circular cross-section of pipes at boundary condition of constant temperature or constant density of the heat flux of the wall are evaluated. Using the method of minimizing the entropy generated allows optimization of the geometry and operating conditions in the apparatus.

4.2 Contributions in the scientific papers submitted for review

I evaluate as scientifically applied contributions, which consist in obtaining and proving new and confirmatory facts, namely:

- Extended criteria for evaluating the energy characteristics of single-phase fully developed laminar flow streams in channels of rectangular, triangular, ellipsoidal, trapezoidal and hexagonal shape and constant wall temperature (2.1.2., 2.2.7.) or constant wall heat flux density. (2.2.4., 2.2.5.);

- Thermo-hydrodynamic characteristics of transient flow in smooth tubes (2.2.8., 2.2.9.) and of single-phase flow using combined intensification (2.1.1., 3.1.6., 3.1.7., 3.2.) 1.);

- Experimentally obtained coefficients of hydraulic resistance and heat transfer in the transient mode of a single-phase flow in a smooth tube (2.2.8., 2.2.9) and in the combined intensification of a single-phase flow in a circular tube for use in shell and tube heat exchangers (2.1.1. ., 3.1.7., 3.2.1.);

- Critical analysis of the criteria used so far to evaluate the effect of using different techniques for intensification of a single-phase heat transfer (2.1.3., 3.1.6., 3.1.8.) and a proposed criterion for preliminary evaluation of the benefits from application of techniques for the intensification of heat transfer at laminar flows in pipes and ducts (3.2.2.);

- By discriminant dimensional analysis, it is justified that the specific pressure drop is a dimensionless parameter that can be used as a reliable tool in the design and optimization of the characteristics of heat exchangers with heat exchange intensifiers (2.2.1);

- Assessment by means of a generalized criterion of turbulent flow efficiency in channels with a dendrite structure aimed to minimize the entropy generated and maximum heat flow in single-phase fully developed turbulent flow (2.2.10, 2.2.11.).

As applied contributions, I evaluate:

- The experimental unit designed to study the intensification of heat exchange in pipes and ducts at single-phase, laminar, transient and turbulent flow (3.2.3.);

- It has been found that techniques for the intensification of heat exchange can be successfully applied to increase the efficiency of solar collectors (3.1.3., 3.1.4., 3.1.5.).

5. Characteristics of the teaching activity of the candidate.

The candidate's biography clearly shows his many years of pedagogical experience. From the presented materials it is evident that Dr. Petkov gives lectures in a total of 9 disciplines (5 of which in master's programs), as follows:

Bachelor Degree Program in Thermodynamics - General Course; Thermodynamics II; Building thermal engineering; Fundamentals of ventilation and air conditioning. For the Master's Degree Program: Architectural, construction and thermal characteristics of buildings; Heat and mass transfer equipment; Secondary energy resources; Intensification of heat exchange; Thermodynamic bases of ventilation and air conditioning. For all disciplines, I assume that they are in the field of competition.

The candidate submitted three manuals in this competition, two of which are self-published and one co-authored with Prof. V. Zimparov. Two of the manuals are, respectively: a manual for laboratory exercises and manual of practical problems, which cover the seminars and the laboratory exercises in Thermodynamics at TU Gabrovo. The compiled steam tables are an important tool for students from different specialties of TU Gabrovo. I believe that all three manuals are in the field of the competition and fully cover the requirements of the rules of TU Gabrovo.

The candidate has participated in the creation of the research laboratory "Intensification of heat exchange", including an experimental basic device for investigating the influence of

different techniques for the intensification of heat exchange. The laboratory is used for experimental research by master and PhD students.

I highly appreciate the evidences presented for giving of out-of-class lessons and the use of new teaching methods directly related to practical training, namely: visits of enterprises with devices and installations installed; used by the students of company catalogs and documentation for preparation of course tasks projects; organization of presentations by leading companies in the field of heating, air conditioning and gas technology.

6. Research, development and implementation activities.

Dr. Petkov has participated in 14 scientific projects, in 4 of them he was the manager. The rest of the projects are under the guidance of Prof. V. Zimparov, which proves that the candidate is a participant in a school established in the Technical University of Gabrovo aimed towards the research and intensification of heat exchange. A good impression makes the fact that most of the projects involve students and PhD students. Dr. Petkov is a member of the Chamber of Engineers in Investment Design - Gabrovo, section "Heating, ventilation, air-conditioning, refrigeration, heat and gas supply" with full design competence.

7. Critical notes and recommendations.

I think that there is some repetition in publications 2.1.2. and 4.2. For example, in both, there is a section “Equations based on the entropy production theorem” and subsequent repetition of the text. There is practically 100 % coincidence in the literature used in publications 4.1 and 4.2. To a large extent, this is naturally due to the similarity in the subject, but I consider that this is no good practice to use the same matrix when presenting experimental or theoretical results.

It is surprising that the list of notable citations of the candidate publications contains a significantly smaller number of citations really existing in the Scopus and WoS databases. The candidate probably included as many as are sufficient to cover the minimum requirements, but I believe that in this case it was necessary to present all merits of the publications submitted.

I appreciate the high number of scientific projects in which the candidate is a leader or participant, but it seems that they are all funded by the Science Foundation of TU Gabrovo. My personal opinion is that participation in several projects funded by the TU Gabrovo should be a prerequisite for successful application for bigger projects such as the Government Research Fund or in international research programs.

8. Personal impressions.

I know my colleague Petkov as a participant in the team of Prof. V. Zimarov. With this team, some professors from UFT-Plovdiv collaborated successfully. I am acquainted with the dissertation of a colleague from UFT, related to the equipment of the research laboratory "Intensification of heat exchange" at the Technical University of Gabrovo.

9. Conclusion.

I think that the production presented by Dr. Petkov is a proof of the accomplishment of a considerable amount of quality and experimental, teaching and implementation work, which fully complies with the requirements of the Rules for acquiring the academic position "Associate Professor". I appreciate the knowledge of the problems, the interpretation of the results, the way that the materials are designed and the practical relevance of the research.

Based on the analysis of the submitted materials in the competition, I give a categorical positive evaluation for them and consider to offer of the members of the distinguished jury, Chief Assist. Dr. Valentin Metodiev Petkov to be elected as an “Associate Professor” in the area of higher education - 5. Technical Sciences, professional field - 5.1. Mechanical Engineering, specialty - Industrial Heat Engineering.

04.11.2019 г. Member of jury: /signature/

/ Prof. DSc. Nikolay Menkov /