

## OPINION

### **of the materials submitted for participation in the competition for occupying the academic position "Associate Professor" in field of higher education – 5. Technical Sciences, professional direction - 5.4. Energy, specialty - Industrial heat engineering**

**Member of the Scientific Jury: Prof. Galya Velikova Dancheva, DSc, PhD**

In the competition for occupying the academic position Associate Professor, announced in the State Gazette, no. 54/25.06.2024 and on the Technical University of Gabrovo website for the needs of the Department of "Power Engineering" at the Faculty of "Mechanical and Precision Engineering", as the only candidate participated Ch. Assistant Plamen Yordanov Penchev, PhD – Technical University of Gabrovo.

#### **1 Overview of the content and results in the presented scientific works**

The candidate is a "doctor" in the scientific specialty "Industrial Heat Engineering". Outside the scientific publications on the dissertation, Ch. Assistant Plamen Yordanov Penchev, PhD participated in the competition with a total of 22 scientific works. The scientific works presented in the list for participation in the competition are entirely in the field of industrial heat engineering. The scientific works are distributed in groups of indicators according to ZRASRB/2019, as follows:

▶ *Group A, indicator 1*: Dissertation abstract for the award of "PhD" educational and scientific degree on the topic "Intensification of heat transfer by combining tubes with deep-rolled turbulators and spiral strips" (2006);

▶ *Group B, indicator 3*: 1 pc. published scientific work in English, presented by the candidate as a habilitation work – monograph on the topic "Heat transfer enhancement with tube inserts: how can we define the best benefit?", ISBN: 978-954-683-702-8 (2024 );

▶ *Group G*

■ *Indicator 7*: 1 article in "Thermal Science" – international scientific journal with Impact Factor, Belgrade, Serbia (Scopus, IF2024=1.1) (2.1.1);

■ *Indicator 8*: A total of 17 scientific publications, distributed by the place of publication as follows:

● 2 articles in international scientific journals: "Thermal Science", 2006 (2.2.1) and "International Journal of Emerging Technologies in Computational and Applied Sciences" (IJETCAS), published by the International Association of Scientific Innovation and Research (USA), 2013 (2.2.2);

● 9 articles in Bulgarian journals: 1 pc. in Mechanics of Machines, 2003 (3.1.1); 1 pc. in "Journal of the Technical University of Gabrovo", 2005 (3.1.2); 2 pcs. in "Textiles and clothing", 2011 and 2012 (3.1.3 and 3.1.4); 5 pcs. in Science & Technologies, 2016 (3.1.5 and 3.1.6), 2020 (3.1.7 and 3.1.8), 2023 (3.1.9);

● 2 reports at international conferences published in: "Proc. 3rd Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, Cape Town, South Africa, 2004 (4.1.1) and 'Proc. 4th Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, Victoria Falls, Zambia, 2003 (4.1.2);

● 4 reports at Scientific Conferences in Bulgaria: International Scientific Conference UNITEH 02, Gabrovo, 2002 (4.2.1 and 4.2.2); International scientific conference UNITEH 03, Gabrovo, 2003 (4.2.3); Scientific Conference with International Participation, Stara Zagora, 2005 (4.2.4);

► 1 textbook "Gas Supply", Electronic edition, 2024 with author Ch. Assistant Plamen Yordanov Penchev, PhD and 1 teaching aid "Heat exchange devices - course lectures and assignments", Electronic edition, 2024 with authors Ch. Assistant Plamen Yordanov Penchev, PhD and Chief Assistant Plamen Bonev, PhD;

Apart from the habilitation work - monograph, out of a total of 18 scientific articles and reports, 7 were published in English. Ch. Assistant Plamen Y. Penchev, Ph.D., is the sole author of 8 scientific papers, including the scientific work presented as a monograph, the textbook "Gas Supply", 5 articles in the country (3.1.5 - 3.1.9) and 1 report at a conference in Bulgaria (4.2.4). The candidate is first author in 2 scientific reports and second author in 8 scientific papers published in foreign publications.

Excluding the dissertation abstract, monograph, textbook and teaching aid, the candidate's scientific output covers 18 scientific works published over a period of 18 years (2006 – 2024). *Based on the indicated statistics in numerical terms, the asset of the candidate according to group G indicators corresponds to 224 items with a minimum number of 200 items.*

#### ► *Group D*

The presented list of citations includes a total of 39 citations, 27 of which in journals with Impact Factor, 10 in journals abroad and 2 in conferences abroad. The asset of the *candidate* under group D is equivalent to 303 items, which significantly exceeds the minimum requirements. The Scopus reference shows that Ch. Assistant Plamen Penchev, PhD has h-index 3.

*The aforementioned confirms that the candidate's asset in quantitative terms satisfies the minimum national requirements according to ZRASRB/2019 and those of Technical University of Gabrovo for occupying the academic position "Associate Professor" in the field of the competition.*

## **2 General characteristics of the candidate's activity**

### **2.1. Educational and pedagogical activity**

Ch. Assistant Plamen Penchev, PhD, led lecture courses on "Heat exchange devices", "Heat and gas supply", "Refrigeration technology" and "Drying technology" in the Bachelor's degree and lecture courses in the Master's degree, as follows: "Refrigeration installations", "Refrigeration and freezing", and "Gas supply systems". Additional information is presented regarding non-auditory employment and innovations in teaching methods, expressed in: 1). Organized student visits to industrial sites related to the taught disciplines; 2). Presentations of leading companies in the field of heating, ventilation and air conditioning systems.

The candidate has by himself developed a 176-page textbook "Gas Supply" and a co-authored teaching aid "Heat exchange devices - course lectures and assignments". During the period 2021 – 2023 Ch. Assistant Plamen Penchev PhD, was the supervisor of 20 graduate students in the "Power Engineering" department.

*The above facts confirm that the candidate has the necessary pedagogical training and qualification to occupy the academic position of "Associate Professor" in the field of the competition.*

### **2.2. Scientific and scientific-applied activity**

In accordance with ZRAS/2019, the scientific work presented as the habilitation work – a monograph on the topic "Heat transfer enhancement with tube inserts: how can we define the best benefit?" is of decisive importance. It is noteworthy that the title of the monograph is duplicated with the title of scientific article 2.1.1 and almost entirely with the title of the third chapter in the monograph itself. Essentially, the monograph offers a critical analysis of the

choice of an appropriate criterion for evaluating the benefits obtained when intensifying heat transfer. In terms of structure, content and contributions, the presented habilitation work fully meets the required scientific level for a scientific monograph and far exceeds the framework of the third chapter. In this aspect, in my opinion, the title "Heat transfer enhancement with tube inserts" is more appropriate.

The scientific research work of the candidate is oriented in the following thematic directions: 1). Research and evaluation of the effectiveness of different techniques for heat transfer enhancement (2.1.1; 2.2.1; 4.1.2; 3.1.1; 4.1.1; 4.2.3; 3.1.2; 4.2.1; 4.2.4); 2). Modeling the process of drying textile materials and designing drying devices and installations (2.2.2; 3.1.3, 3.1.4; 4.2.2; 3.1.6); 3). Investigation of combined water heating systems based on solar collectors and spiral-rolled tube heat exchanger (3.1.5; 3.1.7; 3.1.8); 4). Investigation of a water-to-water heat pump system using a new type of heat exchanger with spirally wound, internally and externally finned tubes (3.1.9); 5). Study the characteristics of bulk materials (3.1.6).

As can be expected, the scientific works published in high-rated international journals were cited - publications on the dissertation with Impact Factor and scientific article 2.2.1 included in the documents for participation in the competition. This asset is the result of teamwork with the participation of the candidate with the leading role of Prof. Vencislav Zimparov, Dsc.

A list of 5 university scientific-research projects with a duration of two or three stages, developed with the participation of the candidate during the period 2010-2023, is presented. In terms of subject matter, all projects are entirely in the field of the competition.

### **2.3. Implementation activity**

The applicant's implementation and applied-scientific activity is impressive. A proof of this is the reference presented by the company "ZIP ENGINEERING" EOOD, Nova Zagora, certifying the participation of Ch. Assistant Plamen Penchev, PhD, as a consultant in the design, construction, repair and reconstruction of a large number of industrial, public and domestic heat engineering facilities and installations in Bulgaria. This confirms the candidate's convincing expertise in the design and construction of heating, gas transmission, heat pump, air conditioning and ventilation installations.

### **3. Contributions and their significance for science and practice**

I propose the following classification and formulation of the main scientific-applied contributions in scientific works:

#### ***A. Creation of new classifications, methods, approaches, algorithms, constructions, models***

- *Evaluation of the efficiency and characteristics of heat exchangers through various intensification techniques, applying the method of minimizing the generated entropy (2.2.1; 4.1.2; 3.1.1; 4.1.1; 4.2.3);*
- *Design parameters of techniques for heat transfer enhancement in shell-and-tube heat exchangers (3.1.2; 4.2.1; 4.2.4);*
- *Kinetic models of drying of textile materials (2.2.2; 3.1.3; 3.1.4);*
- *Combined water heating system based on solar collectors and heat exchanger with spiral-rolled pipes (3.1.5; 3.1.7; 3.1.8);*
- *Characteristics of a "water-to-water" heat pump system using a new type of heat exchanger with spirally wound, internally and externally ribbed tubes (3.1.9);*
- *Generalized methodology for designing dryers with a fountain layer (4.2.2);*

#### ***B. Obtaining and Proving New Facts***

- *The criterion for evaluating heat transfer enhancement approaches based on the limitation of fixed pumping power has been found to lead to inaccurate results, therefore, when*

*using different heat transfer intensification techniques in shell and tube heat exchangers, the FG-1a -criterion should be used, while criterion FG-1b should be used in heat exchange intensification in solar air heaters or solar water collectors (Monograph);*

- *The characteristics of various techniques for heat transfer enhancement in shell-and-tube heat exchangers have been experimentally and theoretically proven and compared (3.1.1; 3.1.2; 4.1.1; 4.2.1; 4.2.3);*

- *The characteristics of a "tube-in-tube" type heat exchanger with a band in the annular space (2.2.1; 4.1.2) have been proven;*

- *Dependencies for the moisture evaporation area and drying intensity of textile materials 50/50 polyester/cotton (2.2.2; 3.1.3; 3.1.4);*

- *Results for heat transfer coefficients for condensation of water vapor on horizontal deep-rolled tubes with spiral strips (4.2.4).*

I accept the author's reference for the applied contributions in their part experimentally and theoretically obtained databases, as well as the development bench for testing the characteristics of a heat pump system "water-water" with the use of a new type of heat exchanger with spirally wound, internally and externally finned pipes (3.1.9).

#### **4. Evaluation of the candidate's personal contribution**

I believe that Ch. Assistant Plamen Penchev, PhD, has made a significant contribution primarily in the applied aspect as a member of the research team of the "Power Engineering" department in the field of industrial heat engineering.

#### **5. Notes and recommendations**

For the future, I would recommend to Ch. Assistant Plamen Penchev, PhD, to intensify his scientific work at the Technical University of Gabrovo.

#### **6. Personal impressions**

I do not know the candidate closely, which is why my impressions are formed on the basis of scientific production and demonstrated activity in implementation and scientific-applied work. This gives me reason to believe that Ch. Assistant Plamen Penchev, PhD, has the necessary qualifications to occupy the academic position of "Associate Professor" in the field of the competition.

#### **7. Conclusion**

**Bearing in mind the above, I propose Ch. Assistant Plamen Yordanov Penchev, PhD, to be elected as an "Associate Professor" at the Technical University of Gabrovo in field of higher education - 5. Technical sciences, professional direction – 5.4. Energy, specialty - Industrial heat engineering.**

14.10.2024

**Member of the Scientific Jury: /signature/  
/Prof. Galya V. Duncheva, DSc, PhD/**