REPORT

On the competition for the academic position " Professor "
in professional field 4.2. Chemical sciences, specialty "Processes and apparatus in chemical and biochemical technology", for laboratory "Transfer processes in multiphase media"
announced in SG No. 77/10.09.2024 г.
with single candidate Assoc. prof. Tatyana Stefanova Pertova, Ph. D.
Member of the scientific jury: Elena Razkazova-Velkova, Assoc. Prof. PhD Eng.
from the Institute of Chemical Engineering, Bulgarian Academy of Sciences (IChE-BAS)

1. Brief biographical data and description of the applicant's scientific interests.

In 1989 Assoc. prof. Tatiana Petrova, graduated from SU "Kl. Ohridski", FMI and acquired the qualification "Mathematics" with specialization "Fluid Mechanics. In the period 1989-1990, as well as in 1996"she works as a mathematician and programmer at the Institute of Mechanics and Biomechanics - BAS. In the period 1991-1996, she was a full-time Ph. D student at the "Kl. Ohridski" University, FMI. In 1996 she started working at IChE-BAS as a research assistant III deg. in the laboratory "Heat and mass transfer processes in gas-liquid systems", where she passed through a research assistant II deg. (2005-2008), and research assistant I deg (2008-2011). In the period 2006-2009, she was a Ph. D student of independent training at IChE-BAS, and in 2008 she successfully defended a Ph. D thesis on the topic: "Mathematical modeling of the distribution of liquid and gas in packedbed columns" in the scientific specialty 02. 10.09. Processes and Apparatus in Chemical and Biochemical Technology'

In 2011 completed her habilitation and is currently an associate professor in the "Transfer Processes in Multiphase Media" laboratory at IChE-BAS. Since 2011 she is a lecturer on Theoretical Mechanics and Mechanics at the European Polytechnic University, Pernik.

From 2018 Tatyana Petrova is the Chairperson of the Colloquium of scientists at IChE-BAS, and from 2024, the Chairperson of the Scientific Council.

2. General characteristics of the candidate's scientific research and applied scientific activity

The candidate's scientific interests and contributions can be summarized in the following 3 groups:

1.Investigation and evaluations of flow distribution in column apparatus;

2. Modeling and optimization of composite and nanocomposite structures;

3. Design of optimal supply chains;

The candidate's scientific and publication activity consists of scientific publications in journals and collections of reports - 85 of which 3 book chapters and 43 publications in the world databases WoS and Scopus, as well as 169 citations.

Assoc. prof. Tatiana Petrova is the head of 2 scientific research projects and a participant in 16. She is supervisor of a successfully defended full-time Ph. D student Konstantina Stefanova, specialty Processes and apparatus in chemical and biochemical technology Topic: Research and modeling of hydrodynamics in a column with modern highly efficient random packings.

3. Evaluation of the submitted materials

The materials submitted for review correspond in volume and content and exceed those required by the rules of the BAS and that of IChE-BAS for acquiring the academic position of "Professor", namely:

1.Publications 25-versus the required 20;

2. Publications with IF/SJR - 23 - against the required 7;

3. Total number of publications: 85 - 40 required;

4. Total number of publications with IF/SJR 43 out of 12 required;

5. Total number of citations: 169 with 50 required;

6. Recommended h-index-7 when 8 is required

According to indicators A, B, Г, Д, E Total - 777 points. (from min 640).

4. *Basic scientific and scientific-applied contributions*

In summary, the main scientific and scientific applied contributions of Assoc. prof. Tatyana Petrova can be formulated as follows:

4.1. Investigation and evaluations of flow distribution in column apparatus

4.1.1. Analysis of quantitative estimates for phase non-uniformity (for gas distribution devices (GDD), and GDD and packings); The studies were carried out with structured and random packings in industrial and pilot apparatus.

4.1.2. Experimental actions to reduce inequality in GRU;

4.1.3. A new graphical method for determination of the number and location of clusters (zones with the same local velocities) along the cross-section of the column;

New criterion equations for determining the pressure drop of dry and wet structured packing (Horizontal sheet packing), as well as the gas velocity at the loading point, taking into account the influence of the geometric characteristics of the packing.

4.1.4. Numerical modeling of the influence of gas flow hydrodynamics on heat and mass transfer in the flow of a single catalyst particle.

4.1.5. New methods are proposed for the identification of model parameters in the diffusion model for the liquid phase; Combining the model with nonuniformity estimates allows simulation and optimization of the design of the collection device (CD) under the packingto more accurately account for the liquid distribution in the nearwall zone.An improved design of irrigator and CD s is also proposed, and missing experimental data are obtained for three types of open structure packings.

4.2. Modeling and optimization of composite and nanocomposite structures

Modeling and optimization of composite and nanocomposite structures (CS and NCS), with and without imperfections, subjected to static or dynamic mechanical loads, taking into account changes in temperature and humidity and the effect of an applied electric field.

The objects in the study are analogs of structures used in industry (blades of wind turbines, elbows (assemblies), sensors, building insulation materials); the factors causing delamination in them are theoretically investigated.

Analytical modeling was used: a 1D "shear-lag" model for the composite structures, and a new analytical two-dimensional model - for the nanocomposites. The optimization of the composite structures was performed by genetic algorithms; they make it possible to simultaneously obtain the optimal values of several model parameters, while satisfying a criterion for a minimum or zero value of the delamination length at the interface of the structures.

4.3. Design of optimal supply chains

The contributions refer to the design of optimal supply chains under different scenarios (the production of one or more dairy products from one or more raw materials, according to one or more technologies, with different numbers of suppliers, factories and markets), under different optimization criteria.

The formulated and solved optimization tasks take into account various aspects of sustainability - environmental, economic and social, as well as combinations of them, under various imposed

restrictions, and according to the needs of the participants in the supply chains. A variant of the optimization was also played with included levels of uncertainties in the search for the products.

5. ***Reflection of the candidate's scientific publications in Bulgarian and foreign literature***

The candidate's publications have been widely reflected in the specialized scientific literature.

6. Critical notes and recommendations.

From the materials provided, the vision for work in the next years is not clearly visible.

7. ***Personal impressions of the reviewer about the candidate***

I know Assoc. Dr. Tatiana Petrova from the moment she started working at IChE-BAS in 1996. I believe that she has always stood out for her original scientific vision and ideas, as well as her exceptional punctuality and efficiency. On a personal level, she is a responsible, dedicated and kind-hearted colleague who knows how to work in a team

CONCLUSION All quantitative indicators for evaluating the candidate's research and academic activity correspond to and exceed the requirements for holding the academic position " Professor". On this basis, I support the candidacy of Assoc. prof. Tatyana Petrova and I recommend to the scientific jury and the Scientific Council at IChE-BAS to award her the academic position " Professor ".

Date: 19.12.2024

Member of the scientific jury:
(Assoc. Prof. E. Razkazova-Velkova)