OPINION

by Dr. Stela Ivanova Minkovska, Assoc. Prof. at Institute of Catalysis – BAS
on the competition for occupation of the academic position "Professor"
in professional field **4.2 Chemical Sciences**,
scientific specialty **"Processes and devices in chemical and biochemical technology"**,
for the needs of the Laboratory "Engineering-Chemical Systems Engineering"
announced in Bulgarian State Gazette, No. 96 of 02.12.2022
with candidate Daniela Boyanova Dzhonova-Atanasova, Dr., associate professor

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

Associate Professor Daniela Boyanova Dzhonova-Atanasova graduated from the Technical University - Sofia with a Master's Degree in Mechanical Engineering, majoring in "Heating, Ventilation and Air Conditioning", after which she completed a one-year post-graduate course in Applied Mathematics and Informatics. In 1988, she was enrolled as a full-time PhD student at the Technical University - Sofia, and during her doctoral studies she was a part-time teacher and led a course - exercises in Fluid Mechanics. In 1993 defends PhD thesis on "Heat exchange processes in two-dimensional free turbulent jets". Her creative path at the Institute of Engineering Chemistry - BAS began in 1994, where she successively held the positions of technologist, research assistant III-I degree, and in 2010 she was appointed an Assistant Professor.

Since 2011, he has held the position of associate professor in the "Transfer Processes in Multiphase Environments" laboratory, of which he has been the head since 2014. Assoc. Prof. Daniela Dzhonova-Atanasova was a scientific secretary at the Institute of Engineering Chemistry (2018-2022), and in 2022 she was elected deputy director. For a period of one year (2012-2013), Assoc. Prof. Dzhonova taught at the European Polytechnic University - Pernik, where she led lectures and exercises in English "Energy from the Ocean" and participated in the development of new bachelor's curricula – "Green energy" and for a master's degree – "Wind energy"

The research work, as well as the scientific interests of Assoc. Prof. Dzhonova, are directed in the field of heat and mass exchange processes in column apparatuses, mathematical modeling, purification of liquids and gases using the processes of absorption, desorption, computer dynamics of fluids, including the study of energy efficiency of technological processes. It works actively in the development of thermal accumulators for the recovery of waste heat and the use of renewable energy sources, as well as integrated technologies using filtration processes.

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

The main scientific and scientific-applied results of Associate Professor Daniela Dzhonova-Atanasova are purposeful and closely oriented to the topic of the announced competition. She is the co-author of a total of 65 scientific publications. Scientific and applied activity is related to research to increase the efficiency of processes in the chemical industry and heat engineering. Thematically, it can be grouped into the following areas:

• Investigation of membrane processes combined with a bioreactor.

The obtained results have important practical applications. The integration of a reaction process with membrane separation was found to allow efficient removal of the reaction product and a favorable shift of the chemical equilibrium, thereby saving energy and space.

Membrane integrated bioreactors reveal significant potential for the production of gaseous and liquid biofuels such as biohydrogen, bioethanol and biodiesel. The combination of bioprocesses and membrane filtration offers an innovative solution to the ecological problem of releasing carbon dioxide into the atmosphere during the production of methane and hydrogen. The possibility of using waste and by-products as additional sources of raw materials allows achieving zero-waste production. The integration of a reaction process with membrane separation is applied in biotechnology to obtain exopolysaccharides, antioxidants, carboxylic acids and to separate/concentrate thermosensitive bioactive compounds, preserving their biological activity.

• improving and increasing the efficiency of processes in packed columns.

Research in this direction is aimed at absorbing harmful components (SO_2, CO_2) from waste gases from the energy and chemical industries, distillation and direct heat exchange for the utilization of waste heat from combustion plants.

The scientific activity of Dr. Dzhonova -Atanasova is related to the participation in projects financed by national and international sources. Dr. Dzhonova participated in 8 projects with national funding - National Scientific Research Fund and Ministry of Education and Science, of which he is the head of two of them with bilateral cooperation. She is a consultant in two projects from the Program for supporting young scientists and postdoctoral fellows of the Ministry of Education and Culture. He also participates in 4 international research projects, 3 of which are funded by EU Operational Programs.

In addition to what has been said so far, I will also note that the candidate for professor, Assoc. Prof. Dzhonova, is the supervisor of two doctoral students, one in Bulgaria and one abroad (Republic of Kazakhstan), and is currently the scientific consultant of one doctoral student from the Institute of Engineering Chemistry of free PhD student.

In view of the number of publications, which exceed the minimum requirements according to the regulations for the development of the academic staff at the Institute of Engineering Chemistry - BAS, I give a very good assessment of the general characteristics of the candidate's scientific-research and scientific-applied activities.

3. Evaluation of the presented materials.

In the competition for professor in the specialty "Processes and apparatus in chemical and biochemical technology", Dr. Daniela Dzhonova -Atanasova participated with 32 articles and one useful model. Of these, 8 presented in the quality of a habilitation work (140 points, according to the criteria of the Ministry of Education and Culture and the regulations of the BAS and the Institute of Engineering Chemistry, collected from 4 publications in Q1, 3 - in Q3 and 1 - in journals with SJR) and 24 - outside it in section D of the reference (325 points) + one useful model (25 points). Of these 24, 3 are in journals falling in Q1, 2 in Q2, 2 in Q3, 10 in Q4, 3 with SJR for the relevant field and 4 book chapters (350 D points in total).

Dr. Daniela Dzhonova-Atanasova participated in a total of 12 projects funded under various programs (FNI - fundamental research and Bilateral cooperation with India and Russia, MES - National Science Program EPLUS, three COST actions, EC Horizon 2020 Program), as a result for which the Institute of Engineering Chemistry - BAS received additional funds. She was the head of the two Bilateral Cooperation projects with Russia and India.

4. Basic scientific and scientific-applied contributions

The scientific and applied scientific results presented by Dr. Daniela Dzhonova-Atanasova were obtained through computational fluid dynamics (CFD) models through solutions of the

Navier-Stokes hydrodynamic equation. An assessment of the influence of the hydrodynamic picture and shear stress distribution during filtration processes was obtained. Several basic configurations of external membrane modules are modeled with tangential mode (cross-membrane flow) or normal mode (membrane-directed flow), as well as with a membrane module immersed in the bioreactor volume.

Data were obtained from an experimental and numerical study of a two-step process consisting of extraction with the help of ultrasound and concentration of biologically active compounds by nanofiltration. The higher extraction efficiency using ultrasound has been proven. Computer simulations have been successfully performed revealing the picture of the complex three-dimensional rotational flow occurring during membrane filtration. The flow characteristics (velocity and velocity gradients) in a conventional stirred bioreactor with an integrated tubular membrane module for integrated value-added material production and recovery were obtained.

The conditions for stable and efficient operation of an exported membrane module integrated with a bioreactor are determined by modeling the mass transfer processes in a filtration cell in tangential and normal mode. Applied results are obtained for membrane efficiency in relation to turbine selection.

Honeycomb type ceramic block filling has been proposed and its application in effective purification of process gases from hydrogen sulfide has been proven, reducing the formation of nitrogen oxides, which suggests a successful application with a noticeable environmental effect.

There are also significant scientific results in the development of efficient thermal accumulators, for example for hybrid systems for heating, cooling and hot water in residential buildings (with a change of phase state), for solar drying installations (storage of apparent and latent heat).

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

Until January 2023, 82 citations were noticed on the works of Associate Professor Dzhonova, indicator D, which exceeds the requirements of this indicator according to the rules of the Institute of Engineering Chemistry for holding the academic position "professor".

6. Critical remarks and recommendations

I have no critical remarks about the candidate. The documents for participation in the competition are designed according to the requirements and contain comprehensive information about the results achieved and the scientific contributions of the candidate.

CONCLUSION

The overall scientific and scientific-applied activity of the candidate is in the field of transfer processes in multiphase environments, which completely coincides with the field and professional direction of the announced competition. The publications presented by the candidate are on the subject of the competition, represent original scientific and scientific-applied developments with a significant contribution in the field of research into integrated technologies with membrane processes and are innovative in nature.

As a result of the above, I am convinced that with her scientific and research activity Assoc. Prof. Dr. Daniela Dzhonova-Atanasova fully meets all the requirements of the Law on holding the academic position "professor", and I propose that she be elected "professor" by

professional direction 4.2. Chemical sciences, scientific specialty "Processes and devices in chemical and biochemical technology" for the needs of the laboratory "Transfer processes in multiphase media" at the Institute of Engineering Chemistry - BAS.

Sofia, 17.03.2023 г.

Prepared the opinion: .....

/Assoc. Prof. Dr. Stela Minkovska/