

## REPORT

regarding to a competition for holding the academic position “**professor**” in professional field **4.2. Chemical Sciences**, scientific specialty “**Processes and Apparatus in Chemical and Biochemical Technology**” for the needs of the laboratory “Transfer Processes in Multiphase Media” of the Institute of Chemical Engineering at Bulgarian Academy of Sciences, announced in the state newspaper № 77 (10.09.2024)

Candidate: **Assoc. Prof. Dr. Elena Nikolaeva Razkazova -Velkova**

Reviewer: **Assoc. Dr. Stela Ivanova Minkovska, Institute of Catalysis - BAS**

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

Assoc. Prof. Dr. Elena Nikolaeva Razkazova-Velkova graduated from the University of Chemical Technology and Metallurgy - Sofia as a Master of Science in Chemical Engineering in 1995, earning the educational and professional degree “Master in Chemical Engineering” in specialty “Chemical Engineering”. In the period from 1997-1999 she was enrolled as a full-time PhD student at the Institute of Chemical Engineering – BAS (IChE-BAS). In 2006 she defended her PhD thesis on the topic “Development of Packings for Column Apparatuses Operating at Extremely Low Densities”. The beginning of the researcher and activist began in 1999 at the Institute of Chemical Engineering - BAS, where she successively held the positions of Research Fellow III degree (1999-2003), Research Fellow II degree (2003-2006), Research Fellow I degree (2006-2012). In 2000, she was awarded the Bulgarian Academy of Sciences Award for young scientists under 30 years old.

In 2012, she assumed the academic position of "Associate Professor" in the laboratory “Transport Processes in Multiphase Media”.

The scientific and applied interests of Assoc. Prof. Razkazova -Velkova are in the field of mass transfer processes and specifically in packed column apparatuses and there are related to experimental and theoretical studies of new fillings designed for extremely low dewpoint densities, increasing the efficiency of absorption in packed columns, the purification of liquids and gases using the processes of absorption, adsorption and kinetic studies. She is actively involved in the development, creation and research of fuel cells with an ecological focus.

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

The detailed review of the results summarized by the candidate, reflected in the Author's Reference for Contributions and the relevant publications outline a certain focus of her scientific research activity towards the purification of flue gases from sulfur dioxide and the construction of fuel elements for waste disposal. She has also achieved scientific and applied scientific results in the field of mass transfer processes and the study of catalysts based on metal oxides for the oxidation of sulfides from model seawater systems.

Assoc. Prof. Razkazova -Velkova was the head of three projects and a member of the team of five projects funded by the National Research Fund (NRF) under the Ministry of Education and Science (NRF-MES). She was also a participant in The National Scientific Program “Low Carbon Energy for Transport and Households” (EPLYUS), funded by the Ministry of Education and Science, as well as in a project under the Seventh Framework Program “Production of hydrogen from the Black Sea waters through a fuel cell using sulfide” ( Hydrogen Production From Black Sea Water By Sulfide-Driven Fuel Cell ) (HYSULFCEL). Associate Professor Razkazova -Velkova has also participated in two projects with, funded through contracts with ministries and departments in the country - Grant Agreement under the Operational Program: “Human Resources Development” - Grant Scheme: BG051PO001-3.3.04 “Support for the Development of Doctoral Students, Postdoctoral Students , Specialists and Young Scientists”



and Programs and Tools for Increasing the Scientific Potential of PhD Students, Postdoctoral Students and Young Scientists in the Field of Chemical and Biochemical Technology and Environmental Protection". She has also performed tasks in two projects with departments, one from the country and one from abroad.

Assoc. Prof. Dr. Razkazova -Velkova was a scientific consultant to a successfully defended PhD student. The candidate carries out expert work by preparing anonymous reviews and evaluations of publications for renowned journals and projects of the Bulgarian Science Fund.

### **3. Evaluation of the submitted materials.**

Assoc. Prof. Elena Razkazova -Velkova is a co-author of 71 scientific publications, of which 28 have been published in refereed and indexed journals with an impact factor (ISI IF). The ones presented by Assoc. Prof. Elena Razkazova -Velkova materials on the competition are grouped by indicator groups, as follows:

**Indicator A** : The diploma for the PhD degree - **50 points** (min. required 50 points);

**Indicator B** : **8** publications in journals with ISI Impact Factor and/or SJR, distributed across quartiles as follows: **1** in Q2, **2** in Q3 and **5** in Q4.

Total points for indicator B - **110 points** (minimum required: 100);

**Indicator G**: **15** journal publications with ISI Impact Factor and/or SJR, distributed across quartiles as follows: **3** in Q1, **2** in Q2, **2** in Q3, **7** in Q4 and **1** and **1** publication without a quartile but with an SJR ( **239 points** );

**1** book chapter in an international academic publishing house (**15 points**);

**2** patents for which the applicant has submitted issued protection documents (50 points).

Total number of points under indicator D – **304 points** (minimum required: 220);

**Indicator D**: Citations in scientific publications, referenced and indexed in world databases of scientific information (Web of Science and Scopus) – Total of 62 citations across 221 publications.

Total number of points for indicator E – **124 points** (minimum required 120 points);

**Indicator E**: Scientific consultant for one successfully defended PhD student ( **25 points** ); Leader of **2** ( **40 points** ) and participation in **1** ( **10 points** ) projects funded by the National Science Foundation-MES;

Participation in **1** project funded under the national program of the Ministry of Education and Science " Low-carbon Energy for Transport and Households (EPLUS)" ( **10 points** )

Participation in **1** project funded under the 7th Framework Programme of the European Union ( **20 points** ). Total funds attracted from projects led by the candidate – ( **67.41 points** )

Total number of points under indicator E – **172.41 points** (min. required 150 points);

Assoc. Prof. Dr. Elena Razkazova -Velkova also meets the additional criteria of the Institute of Chemical Engineering at the Bulgarian Academy of Sciences for holding the position of "professor" by submitted the following information:

Total number of publications - **71** (min. required 40);

Number of publications in journals min. required with ISI Impact Factor and/or SJR - **28** (min. required 12);

Number of publications outside those presented during habilitation – **47** (min. required 20)

Number of publications in journals with ISI Impact Factor and/or SJR beyond those presented during habilitation – **25** (min. required 7).

Total number of citations noted on publications in journals referenced and indexed in the world's databases of scientific information ( Web of Science and Scopus ) – **62** (min. required 50).

Recommended Hirsch index – **6** (min. required 8).

From the indicators presented above, it is evident that the candidate fully meets the requirements of the Regulations on the conditions and procedure for holding academic positions



at the Bulgarian Academy of Sciences, the Rules for the implementation of the Law on the Development of the Academic Staff in Bulgaria and the additional criteria of the the Institute of Chemical Engineering at the Bulgarian Academy of Sciences for holding the academic position of "professor".

#### **4. Main scientific and scientific-applied contributions**

From the materials submitted for review and results obtained by the candidate, the following scientific and applied scientific contributions can be summarized:

1. Raschig Super-Ring (RSR) packings have been developed and tested. Data for hydraulic RSR resistance, reflecting the geometry of the packing and the column recharge for successful design and correct structural sizing of industrial apparatus.
2. Proposed and implemented methods for cleansing on hydrogen sulfide and sulfur dioxide from marine water and from industrial waste in columns devices .
3. A new electrochemical method for the simultaneous purification of sulfur dioxide and hydrogen sulfide has been developed, and the optimal conditions for simultaneous sulfur dioxide reduction and oxidation have been found of hydrogen sulfide.
4. An absorption-adsorption method has been developed for the capture of sulfur dioxide from flue gases using various ion exchange resins. The process is carried out in a tray column with bells. Convection-diffusion and average-concentration models have been developed.
5. An energy-efficient method for flue gas purification from SO<sub>2</sub> in small-capacity packed-column combustion systems has been developed using the improved Wellman-Lord method for efficient and waste-free operation with coal and other conventional fossil fuels, in compliance with all environmental protection regulations.
6. Methods for sulfide oxidation and nitrate reduction in fuel cells have been developed. Fuel cells with an ecological focus have been designed for the neutralization of various pollutants.
7. A method for microbiological oxidation of sulfides and chemical denitrification of nitrates in waste streams using different strains of microorganisms has been developed. Fuel cells have been constructed, allowing simultaneous oxidation of sulfides and reduction of nitrates using electrodes in the anode compartment.
8. An electrochemical method has been developed for oxidizing Black Sea waters containing H<sub>2</sub>S and converting it into sulfate, thereby releasing energy.
9. Catalysts based on metal oxides (Co<sub>3</sub>O<sub>4</sub>, Mn<sub>3</sub>O<sub>4</sub>, Fe<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub>) incorporated on activated carbon have been successfully studied for the oxidation of sulfides from model seawater systems. The catalytic activity of activated carbon obtained under the same conditions in fuel cells and outside them has been evaluated.

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

To November 2024, 62 citations were noted on the works of Assoc. Prof. Razkazova-Velkova, indicator D, which exceeds the requirements of this indicator according to the regulations of the Institute of Chemical Engineering for holding the academic position of "professor".

#### **6. Critical remarks and recommendations**

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

## CONCLUSION

The publications submitted by the candidate are on the topic of the competition and represent original scientific and applied scientific developments with a significant contribution to the development and application of waste-free technologies for the purification of hydrogen sulfide and sulfur dioxide from seawater or industrial waste in order to obtain clean products and energy.

As a result of the above, I believe that the materials presented by Assoc. Prof. Dr. Razkazova - Velkova fully comply with the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, as well as the Regulations on the terms and conditions for occupying academic positions at the ICH-BAS. I confidently give my positive assessment and propose to the esteemed Scientific Jury and the Scientific Council of the Institute of Chemical Engineering - BAS to award the academic position "**Professor**" to **Assoc. Prof. Dr. Elena Razkazova -Velkova** in professional field 4.2. Chemical Sciences, scientific specialty "**Processes and Apparatuses in Chemical and Biochemical Technology**" for the needs of the laboratory "Transfer Processes in Multiphase Media".

Sofia, 03.01.2025

Reviewer:  .....

/Assoc. Prof. Stela Minkovska, PhD/