

Scientific Opinion

By Prof. Dr. Daniela Ilieva Batovska, Institute of Chemical Engineering, BAS

Regarding: Competition for "Professor" in the Professional Field 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biotechnological Engineering) for the needs of the laboratory "Transfer Processes in Multiphase Media" at the Institute of Chemical Engineering, Bulgarian Academy of Sciences (ICE, BAS), as announced in the State Gazette No. 77 of September 10, 2024, with candidate Assoc. Prof. Dr. Elena Nikolaeva Razkazova-Velkova

1. General Evaluation of the Candidate.

Dr. Elena Razkazova-Velkova has been an Associate Professor at ICE-BAS since 2012. A respected scholar in chemical engineering, her research focuses on innovative and sustainable technologies with wide industrial applications, contributing to more environmentally friendly and efficient solutions. She is a co-author of two patents and has published 71 papers in journals indexed in Web of Science and Scopus. Her work has received 162 citations, highlighting its significance and international recognition.

As an Associate Professor, Dr. Razkazova-Velkova leads three national scientific projects, one of which she manages as the project leader from the ICE, BAS, within a consortium. Two projects are actively underway, while one has been successfully completed. The total funding for these projects amounts to 337,000 BGN. Additionally, she is involved in an international project under the EU's 7th Framework Programme. Dr. Razkazova-Velkova has supervised one PhD student to successful defense and is currently mentoring another, whose dissertation is in progress.

2. Evaluation of the Materials Submitted for the Competition.

The candidate has submitted a complete set of required documents and materials for participation in the competition. The materials are meticulously prepared and comprehensive. Assoc. Prof. Razkazova-Velkova is presenting 22 publications, of which 3 are in Q1 journals, 3 in Q2, 2 in Q3, 12 in Q4, and 2 fall outside any quartile category. In addition to her publications, she has included a book chapter and two patents. The total number of citations for the publications included in the competition is 62.

The submitted materials fully meet the requirements for the academic position of "Professor" in accordance with the Law on the Development of Academic Staff in the Republic of Bulgaria (ZRASRB), the Rules for the Implementation of ZRASRB at the Bulgarian Academy of Sciences (BAS), and the Methodology for the Advancement of Scientists at the Institute of Chemical Engineering, BAS.

3. Key Scientific and Applied Achievements.

In her habilitation report, Dr. Razkazova-Velkova highlights significant scientific contributions in key areas of chemical engineering, with achievements that are both theoretically robust and practically applicable.

She has successfully developed precise equations to predict the pressure drop of high-efficiency metal packings for columns, which can be used to optimize industrial processes. Additionally, she proposed dimensionless criteria equations for determining the dynamic holding capacity of packings, applicable in the design and structural sizing of industrial equipment.

Dr. Razkazova-Velkova has made significant contributions to flue gas desulfurization, particularly through the optimization of the Wellman-Lord regenerative method for sulfur dioxide (SO₂) removal. She has successfully improved the process's efficiency while reducing capital costs. The enhanced method is especially suitable for small combustion systems using coal and other conventional fuels, offering both economic and environmental benefits that meet modern sustainable development goals. Additionally, she has developed an integrated approach combining physical absorption and chemical adsorption for SO₂ capture using ion-exchange resins, ensuring regenerative, waste-free capture with high efficiency and minimal environmental impact. These results demonstrate the method's potential for scaling up and industrial implementation.

The candidate has conducted significant research in catalytic oxidation of pollutants, using innovative approaches to tackle environmental challenges. Her key contributions include developing a method for photocatalytic oxidation of azo dye with TiO₂ deposited on activated carbon and creating a novel electrochemical method for simultaneous removal of sulfur dioxide and hydrogen sulfide from industrial gas streams (related to a patent). Her studies demonstrate the effectiveness of metal catalysts (Co₃O₄, Mn₂O₄, Fe₂O₃, ZrO₂) on activated carbon for oxidizing sulfides in seawater. Additionally, she has explored manganese-based electrocatalysts deposited on fullerenes and carbon nanotubes, aiming to improve catalytic reactions and enhance the efficiency of processes for removing toxic pollutants like sulfites and nitrites.

Dr. Razkazova-Velkova has made significant contributions to the design and research of fuel cells for treating various pollutants, with some results being patented. In enhancing their efficiency, she has demonstrated profound expertise in catalysis and the mechanisms behind these processes. Notably, her use of microorganisms for the simultaneous oxidation of sulfides and reduction of nitrates is particularly impressive. This innovative approach offers a new method for improving pollution treatment, providing sustainable and environmentally friendly solutions for reducing toxic substances in industrially contaminated environments.

4. Critical Remarks and Recommendations.

I have no critical remarks. I wish Assoc. Prof. Razkazova-Velkova success in executing her well-formulated plans for future work. I recommend that she continue to actively mentor young scientists in this promising field, sharing her experience and knowledge to advance innovative approaches in catalytic processes and environmental protection.

5. Personal Impressions of the Candidate.

I know the candidate personally. Elena is a kind and approachable person with a broad range of knowledge and interests. She excels at organizing teamwork and creating an inspiring atmosphere that motivates her colleagues to achieve outstanding results. In addition to her professionalism, she is always willing to help and share her ideas and experience.

6. Conclusion.

In light of Dr. Elena Razkazova-Velkova's scientific and leadership achievements, as well as her ability to meet high standards in both national and international contexts, I am confident that her candidacy for the academic position of "Professor" is fully justified and merits support.

I recommend Assoc. Prof. Dr. Elena Nikolaeva Razkazova-Velkova for the position of "Professor" in the field of 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biotechnological

Engineering) for the "Transport Processes in Multiphase Systems" laboratory at the Institute of Chemical Engineering, Bulgarian Academy of Sciences.

December 7, 2024

Sofia

Jury Member:



/Prof. Dr. Daniela Batovska/