

О P I N I O N

by Prof. Maxim Boyanov

regarding the materials submitted for the competition for the academic position of Professor in professional field 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biochemical Technology), for the needs of laboratory "Innovative Processes and Systems Engineering", Institute of Chemical Engineering - BAS, announced in State Gazette No. 37/ 21.04.2026.

The only candidate to submit documents for the announced position is Assoc. Prof. Elisaveta Kirilova.

Assoc. Prof. Kirilova graduated from the University of Chemical Technology and Metallurgy (HTMU)-Sofia in 2000, as a Master of Chemical Engineering, defending her thesis titled "Influence of Vibration on the Properties of a Titanium Dioxide Flow". From 2001 to 2011 she worked as a research associate at the Institute of Chemical Engineering at the Bulgarian Academy of Sciences (ICHe-BAS). During this time, she also defended her doctoral thesis on the topic "System-oriented approach for environmentally friendly management of multipurpose chemical and/or biochemical production systems" (2007-2011). From 2011 to 2018, she worked at IChE-BAS as an assistant professor, and in 2018 she successfully passed the competition for associate professor and has been working as an associate professor at IChE-BAS to date. In addition to her scientific work, Assoc. Prof. Dr. Kirilova has also been actively involved in scientific and administrative activities, and since 2018 she has held the position of head of the "Innovative Processes and Systems Engineering" laboratory, and since 2022 she has also been the scientific secretary of the Institute of Chemical Engineering. Since 2011 she has participated in 19 scientific projects funded by national and international institutions, of which she has been the project leader of 3. She is currently the leader of a project funded by the Bulgarian Scientific Investigations Fund (SIF) on the topic "Supply chains for the sustainable production and distribution of hydrogen from various raw materials".

The candidate for the professor position, Assoc. Prof. Elisaveta Kirilova, is participating in the competition with a total of 27 publications (25 articles in scientific journals and two book chapters), published between 2018 and 2022.

The articles are distributed as follows:

In journals with an impact factor – 25:

Chemical Engineering Transactions-12; Bulgarian Chemical Communications-4; Journal of Ecological Engineering-1; Energy-1; Energies-1; Clean Technologies and Environmental Policy-1; Computers & Chemical Engineering-1; Journal of Applied Mathematics and Mechanics-1; Journal of Theoretical and Applied Mechanics-1; Journal of Applied and Computational Mechanics-1; U. Porto Journal of Engineering-1.

In journals without an impact factor – none are presented.

Reports from scientific forums, printed in full text – none are presented.

Participation in Bulgarian and international conferences – 114.

The 25 publications in the application have been cited 92 times between 2018 and 2026. In total, the candidate has 594 citations of 52 articles (out of a total of 78) that are seen in global databases since 2006; Hirsch factor-8, sufficient for the additional requirements for academic growth in IChE-BAS.

The submitted 25 articles are distributed by quartiles as follows: Q1-6, Q2-1, Q3-12, and Q4-6.

Assoc. Prof. Kirilova has been the lead scientist on 3 projects funded by sources from Bulgaria (SIF 2011, 2019-2022, and 2024-2027). She has also participated in 5 scientific projects funded by Bulgarian agencies, 4 international cooperation agreements, 1 project under a European program, and 6 scientific projects funded from abroad (with researchers from Germany). Her successful project proposals and her participation in numerous other scientific projects testifies to the candidate's extensive scientific and administrative experience.

Assoc. Prof. E. Kirilova has extensive experience in preparing reviews and opinions for scientific degree and academic position competitions, has prepared many anonymous reviews for journal publications, and has experience in reviewing project proposals and project reports for proposals to the Bulgarian Scientific Investigations Fund. She has amassed significant administrative experience as the head of one of the three laboratories at IChE-BAS (2018-present) and as the scientific secretary of IChE-BAS since 2022. Her experience in the direct scientific supervision and graduation of graduate students or postdocs could not be evaluated, as no data are presented.

The main scientific interests of Assoc. Prof. Kirilova are in the field of mathematical modeling and optimization of supply chains. Her approach to solving optimization problems is based on artificial neural networks and stochastic/robust optimization methods. These modern methods have been applied in solving optimization problems related to the production of biofuels and dairy products, as well as in wastewater treatment systems. Additional application of these methods has been found in modeling the mechanical behavior, interface stresses and delamination of layered nanocomposites, such as graphene-, hBN- and WS₂-based structures, using variational methods, analytical models, experimental validation and genetic algorithms for multiparameter optimization.

The main contributions of the candidate are in 4 science areas, which can be systematized as follows:

- Development of methods for improving the sustainability and energy efficiency of municipal waste treatment systems applying the autothermal thermophilic aerobic sludge digestion (ATAD) process. A new optimization approach for the thermal integration of the processes, a new approach for reducing the computational complexity of the task, and a method for assessing the effect of uncertain parameters in the model have been developed. As a result, models have been created and tested on real production data, which have subsequently been extrapolated to assess the effects of various process improvements. The results of the research provide additional information that is used in making engineering decisions in these processes (publ. 1,2,3,4,5,6, and chapters of book 1 and 2);

- Design and optimization of supply chains for the production and distribution of biofuels. Several starting resources in the process were tested separately, as well as an interconnected model in which waste products from dairy processing are used as input in the production of biodiesel. A deterministic mixed-integer linear programming (MILP) model was used for an integrated assessment of the economic and environmental effects of the production. Based on the application of the model on real data, estimates were obtained for the optimal areas of activity in Bulgaria, as well as quantitative dependencies between the economic and environmental effects of production (publ. 8,9,10,15);

- Design and optimization of resource-supply chains for the production and distribution of dairy products. The developed model considers 4 interconnected sides of the production, taking into account the relationships between technological, organizational, environmental, and social factors. An improved approach to solving the optimization

problem was also developed. The dependencies and optimal conditions between conflicting factors such as profit and environmental impact were established, taking into account real data from the relevant production. The results of the research provide a basis for informed management decisions in the multi-parametric space of this important production for Bulgaria. (publ. 7,11,12,13, 21,22,23,24);

-Determination of the factors leading to delamination(destruction) of layered nanocomposites. A two-dimensional model of the stress function has been developed, including minimization of the additional deformation energy in three-layer nanocomposite structures (graphene/SU-8/PMMA, hBN/interface/PMMA, WS₂/SU-8/PMMA). Genetic algorithms for multi-parametric optimization have been used, allowing for the assessment of practical factors such as the length and thickness of the layers, and the assessment of their mechanical load. Based on the model, criteria for the destruction of these structures have been obtained, and the results have been compared with experimental data from the literature. The significance of the various impacts (mechanical, temperature, and humidity) for the destruction of the bonds in the composite structure has been established. The above results make it possible to give practical recommendations for the production of new materials with improved properties and their area of applicability (publ. 16,17,18,19,20,25);

CONCLUSION:

The submitted materials meet or exceed the requirements of the Internal Regulations of IChE-BAS, the Regulations on the conditions and procedure for acquiring scientific degrees and occupying academic positions in the Bulgarian Academy of Sciences, the Act on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Implementation of the ZRASRB. I note a lack of experience in the direct supervision of graduate students or postdocs; however, this is compensated by the additional scientific and administrative experience gained from the scientific management of one of the three Laboratories at the Institute. I hereby give my positive assessment of the candidate in the competition for the academic position of professor in the professional field 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biochemical Technology) and I will vote "Yes" for the competition committee to propose to the Scientific Council of IChE to confirm Assoc. Prof. Elisaveta Kirilova as Professor.

Sofia, 31.08.2026.


(Prof. Maxim Boyanov)