

## STANDPOINT

by competition for the academic position of "Associate Professor" in the professional direction 4.2. Chemical sciences (Processes and devices in chemical and biochemical technology), for the needs of the " Innovative processes and systems engineering " laboratory at the Institute of Chemical Engineering – Bulgarian Academy of Sciences announced in SG no. 77 of 10 September 2024 with candidate Ch. Assist. Prof. Dr. Rayka Kirilova Vladova  
The standpoint was prepared by: Prof. Dr. Eng. Kosta Petrov Boshnakov

**1. General characteristics of the candidate's scientific-research and scientific-applied activities.** The research work and competencies of ch. assist. Rayka Kirilova Vladova are related to mathematical modeling, multi-objective optimization, stochastic optimization, sustainable control of resource supply chains (RSCs), wastewater treatment plants, autothermal thermophilic aerobic wastewater treatment (ATAD), energy integration, improving the sustainability of chemical and biochemical processes and production systems, minimizing environmental impact, and investigating the influence of geometry and magnitude of axially applied mechanical load on delamination in a three-layer nanocomposite.

The professional CV of ch. assist. Rayka Vladova shows that she has participated in the development of the following projects: (1) Project "Sustainable Systems, Sustainable Processes, Sustainable Environment", Contract No. DN0714/15.12, funded under the competition "Fundamental Scientific Research" - 2016 of the Scientific Research Fund of the Ministry of Education and Science. Project duration: 2016–2019; (2) Project "Sustainable Resource Supply Chains in Relation to Environmental, Economic and Social Criteria", Contract No. KP06-N37/5 of 06.12.2019, funded under the competition "Fundamental Scientific Research" - 2019 of the Scientific Research Fund of the Ministry of Education and Science. Project duration: 2019–2022; (3) Project "Optimal safe loading and geometry for layered nanocomposites under thermo-mechanical loading", Contract No. KP06-N57/3 of 15.11.2021, funded under the competition "Fundamental Scientific Research" - 2021 of the Scientific Research Fund of the Ministry of Education and Science. Project duration: 2021–2025; (4) Project "High-efficiency hybrid extraction processes for the separation of organic and inorganic substances based on the principles of liquid membranes and liquid-liquid chromatography", Contract No. KP-06-RUSIA-16, funded under the "Competition for projects under bilateral cooperation programs - Bulgaria - Russia" - 2020" of the Scientific Research Fund of the Ministry of Education and Science. Project status: with final report submitted; (5) Project "Modeling and experimental studies of interfacial mass transfer in distillation, absorption, adsorption and catalytic processes in industrial column apparatus", funded under the "Competition for projects under bilateral cooperation programs - Bulgaria - Russia" - 2018-2019" of the Scientific Research Fund of the Ministry of Education and Science.

Ch. assistant Rayka Vladova was the scientific leader of the following projects: (1) "Mathematical approach for design and reconstruction of wastewater treatment plants to increase sustainability and energy efficiency", National Program "Young Scientists and Postdoctoral Fellows" Module "Postdoctoral Fellows"; (2) For co-financing of an international scientific forum on the topic: "1st International Scientific Conference on Cleaner Energy and Chemical Engineering for Sustainable Circular Economy: CLES-CE 2022", No. KP-06-MNF/11,

financed under the “Program for Holding International Scientific Forums” of the Scientific Research Fund of the Ministry of Education and Science.

Ch. assistant Rayka Vladova is the sole author of one book chapter and co-author of another book chapter. She has been the chair of the organizing committees of two conferences.

**2. Basic scientific and scientific-applied contributions.** The scientific papers submitted for participation in the competition contain the following more important scientific, scientific-applied and applied contributions:

***I. Investigation of the processes and installation for autothermal thermophilic aerobic wastewater treatment (ATAD)***

1. In order to improve the energy efficiency and sustainability of ATAD, an energy integration approach is proposed.
2. Two mathematical models of energy integration with one and two heat storage tanks are proposed.
3. An approach to solve a two-stage stochastic optimization problem for the design of a thermally integrated bioreactor ATAD system is applied.
4. Mathematical models of ATAD industrial system with feedforward artificial neural networks have been developed.
5. A decision-making approach is proposed, based on calculating the flexibility index of already obtained solutions of a stochastic optimization model with multiple scenarios for the reconstruction of a thermally integrated two-stage bioreactor ATAD system.
6. An approach for optimal reconstruction of a thermally integrated two-stage ATAD system operating under uncertainty is presented, based on a two-stage stochastic optimization model for thermal integration with an optimization criterion - the annual capital costs for reconstruction of the thermally integrated system and its operating costs.

***II. Design of resource supply chains (RSCs)***

7. An optimization approach was applied for short-term design of a portfolio of "green" products of a three-tier "green" resource supply chain (RSC) of a dairy industry production complex.
8. A deterministic optimization approach is proposed for designing a product portfolio of a sustainable resource supply chain, including suppliers, factories and markets for the production of dairy products using different recipes.
9. An approach is proposed for the optimal design of a sustainable combined dairy and biodiesel/diesel RSC, using dairy waste as a feedstock generated from dairy production.
10. A mixed integer linear programming (MILP) approach is proposed for the design and control of a resource supply chain (RSC) for biodiesel production.
11. A mathematical model for mixed integer linear programming (MILP) has been applied for optimal design and planning of a RSC for biodiesel production in Bulgaria from sunflower and rapeseed raw materials.

***III. Analysis of wastewater treatment plants***

12. Municipal wastewater treatment plants were studied to determine the average monthly electricity consumption required to treat one cubic meter of wastewater.

***IV. Investigation of the influence of geometry and magnitude of axially applied mechanical load on delamination in a three-layer nanocomposite.***

13. The influence of geometry (layer thickness and length) and the magnitude of the axially applied stress on delamination in three-layer nanocomposites graphene/PMMA (polymethyl methacrylate) and tungsten disulfide (WS<sub>2</sub>)/SU-8/PMMA has been theoretically investigated.

14. The application of a two-dimensional "stress-functional" method for analytical description and comparison of deformations in the graphene/epoxy/polymethyl methacrylate (PMMA) nanocomposite structure under three types of loading - mechanical, thermal and thermo-mechanical - has been theoretically investigated.

15. A two-dimensional "stress-functional" method was applied to model the axial strain distribution in flakes (a thin layer with atomic thickness/"monolayer") of tungsten disulfide (WS<sub>2</sub>) embedded in an epoxy/polymethylmethacrylate nanocomposite structure subjected to axial tensile stress.

**3. Reflection of the candidate's scientific publications in Bulgarian and foreign literature.** The documents for participation in the competition include a list of 33 citations of scientific works, with the participation of ch. assist. Dr. Rayka Kirilova Vladova. Ch. assist. Vladova has an H index of 4.

**4. Critical notes and recommendations.** I have no significant notes or recommendations.

**5. Personal impressions about the candidate.** I barely know the candidate ch. assistant Dr. Rayka Kirilova

**CONCLUSION**

Ch. Assist. Prof. Dr. Rayka Kirilova Vladova participated in the competition with 33 scientific papers, of which 20 are in journals with an Impact Factor or impact rank. He is the author of one book chapter and co-author of another book chapter. 33 citations were noted in scientific publications, referenced and indexed in world-renowned databases of scientific information, or in monographs and collective volumes. She has participated in the development of five projects and led two others. My assessment of the candidate's overall performance is positive!

Regarding the fulfillment of the requirements for holding the academic position of "associate professor" at the IChE-BAS under criterion 1 - the requirements are met, under criteria 2-7 the minimum requirements are exceeded. Criterion 8 (H-index) is met and is 4.

Ch. Assist. Prof. Dr. Rayka Kirilova Vladova has satisfied all the requirements of ZRASRB, the Regulations for its implementation, the Regulations for the terms and conditions for acquiring scientific degrees and holding academic positions at the BAS, as well as the requirements for holding the academic position of "Associate Professor" at IChE – BAS

**Everything stated in the statement gives me reason to propose that Ch. Assistant Professor Dr. Rayka Kirilova Vladova to take the academic position of "Associate Professor" in the professional direction 4.2. Chemical Sciences (Processes and Apparatus in Chemical and Biochemical Technology) at the Institute of Chemical Engineering - Bulgarian Academy of Sciences.**

Date: 2.01.2025

Prepared the statement: 

/Prof. Dr. Eng. Kosta Boshnakov/