

REVIEW

by Assoc. Prof. Plamen Georgiev, Ph.D.

of the materials submitted for the competition for the academic position of “Professor” in professional field 4.4 “Earth Sciences” and scientific speciality “Environmental Protection Systems and Devices” for the needs of the Department of Engineering Geoecology at the Faculty of Geology and Exploration of the St. Ivan Rilski University of Mining and Geology, Sofia

In the competition for the academic position of “professor” in professional field 4.4 "Earth Sciences" and the scientific specialty "Systems and Devices for Environmental Protection," announced in the State Gazette for the needs of the Department of Engineering Geoecology at the Faculty of Geology and Exploration, **only one candidate applied, Associate Professor Anatoly Tsankov Angelov, PhD**, and the documents he prepared were structured and submitted in accordance with the requirements of the adopted *“Rules for Filling Academic Positions at the St. Ivan Rilski University of Mining and Geology.”*

The review I have submitted was prepared and presented in my capacity as:

- Member of the academic jury appointed by order of the Rector of UMGS, RD-13-7 dated February 10, 2026, pursuant to the Law on the Development of Academic Staff of the Republic of Bulgaria, its Regulations, and the regulatory documents of University of Mining and Geology;
- Reviewer for the competition by decision of the first meeting of the Academic Jury, held on March 19, 2026.

1. Professional Biography

Anatoly Angelov holds a master’s degree in Biotechnology from the Technical University of Sofia. He has been a member of the Department of Engineering Geoecology at St. Ivan Rilski University of Mining and Geology since 1996. Between 1996 and 2011, he successively held academic positions ranging from “Assistant” to “Senior Assistant” in the department. In 2010, he earned his PhD in the scientific speciality *"Systems and Devices for Environmental Protection"*, and he was promoted to Associate Professor in the same scientific speciality in 2012. The candidate’s brief creative biography shows that his entire professional career has been linked to the Department of Engineering Geoecology, with Assoc. Prof. Anatoly Angelov plays a

significant and indispensable role both in the development of the department's research areas in the scientific disciplines of "*Earth Sciences*" and "*Biotechnology*", as well as in the organisation and adaptation to the changing requirements for the education of students at various educational and qualification levels in the fields of "*Ecology and Environmental Protection*" and "*Biotechnology*".

2. General description of the submitted materials

The candidate submitted the following materials as part of the procedure:

- A copy of the State Gazette, Issue No. 01/January 6, 2026;
- Copies of diplomas: 1) Diploma of completed higher education, academic degree "Master's," 2) Diploma of acquired academic degree "PhD" 3) Certificate of holding the academic position of "Associate Professor," thereby fulfilling criterion A of the minimum requirements for holding the academic position of "Professor" under the current Regulations of University of Mining and Geology;
- Creative CV;
- Documents from St. Ivan Rilski University of Mining and Geology, Official note regarding work experience at the University;
- Statement regarding original scientific and applied scientific contributions in the candidate's works;
- Statement of compliance with the minimum national and institutional requirements for the candidate regarding their participation in the competition under the Research Area "*Earth Sciences*";
- List of the candidate's scientific works;
- Statement regarding the candidate's participation in presentations at scientific forums (congresses, conferences, symposia);
- Abstracts of the candidate's scientific works;
- Statement regarding open citations of the candidate's scientific works, including a list of citing publications with specified URLs;
- Record of the candidate's supervision of doctoral students;
- Record of the candidate's participation in research and educational projects;
- Record of funds secured through research and educational projects;
- Certificate of the candidate's teaching load.

3. General overview of the candidate's research and applied research activities

The research and applied research activities of Assoc. Prof. A. Angelov, in the period following the acquisition of his doctoral degree and his habilitation to the academic rank of "associate professor", is entirely focused on the scientific speciality "*Systems and Devices for Environmental Protection*", namely:

- Microbial fuel cells based on microbial sulfate reduction or microbial photosynthesis processes for the treatment of water from mining activities contaminated with heavy metals or for improving the quality of biogas produced, respectively;
- Combining different types of biological processes into integrated bioelectrochemical systems for the comprehensive removal of various pollutants (heavy metals, biodegradable organic compounds, hydrogen sulfide, ammonium ions) and the restoration of the quality of contaminated water;
- The influence of various environmental factors and technological parameters on the operational efficiency of the designed microbial fuel cells;
- Development of a system for monitoring and controlling technological parameters during the operation of microbial fuel cells for the treatment of wastewater from the mining industry;
- Types of anaerobic cells and constructed wetlands for the treatment of acidic mine drainage contaminated with heavy and toxic metal ions;

Research activities in the aforementioned scientific fields were conducted systematically, continuously, and consistently from 2012 to 2026, primarily by doctoral students and/or members of the Department of Engineering Geoecology's academic staff. This is evidence of both the consistent development and expansion of the scientific foundation and the department's consistent growth in scientific potential.

Other areas of research conducted by Assoc. Prof. A. Angelov, during the aforementioned period, includes:

- Photocatalytic decolorisation of azo dyes using zinc oxide-based nanoparticles;
- Assessment of the biomethanation potential of activated sludge generated by domestic wastewater treatment plants;
- Studies on improving oxygen transfer in a column-type bioreactor, and/or depending on the applied mixing method;
- Monitoring and assessment of surface water and soil contamination in areas with active mining operations;
- Approaches for the restoration of disturbed land and the stabilization of mining industry waste with acid-generating properties;
- Methods for reducing sulfate concentrations in wastewater and water sources affected by the mining and processing industries;

- Environmental risk management through: analysis of CO₂ capture and storage technologies and the resulting short- and long-term environmental risks; opportunities for utilising unconventional hydrocarbon sources.

Publications in these scientific fields are authored by a team of researchers, which is understandable given the multidisciplinary nature of the research.

4. Publication Activity

- The documents prepared by Assoc. Prof. Angelov include a list of scientific publications that contributed to the award of his doctoral degree and to his participation in the competition for the academic position of "associate professor." The scientific publications in the two lists presented cover the period 1995–2012, thereby fully satisfying the requirement of Article 19, Item 7, Paragraph 2 of the Rules for Appointment to Academic Positions at University of Mining and Geology;
- In the announced competition, Assoc. Prof. Angelov has 64 scientific publications, co-authorship in one collective monograph, and one university textbook, all submitted in accordance with the criteria outlined in the adopted Appointment to Academic Positions at University of Mining and Geology.

№	Indicator	Type scientific publication	Number
1.	C	Scientific publications in journals that are peer-reviewed and indexed in global scientific databases	6
2.	G	Scientific publications in journals that are peer-reviewed and indexed in global scientific databases	6
		Scientific publications in peer-reviewed journals that are not indexed in major databases or in edited scientific volumes	52
		Co-authorship of a published collective monograph	1
3.	E	Published university textbook	1

Under Criterion B, which requires a habilitation thesis or scientific publications in journals that are cited and indexed in internationally renowned scientific databases (*Web of Science/Scopus*), Assoc. Prof. A. Angelov has contributed 6 publications. Taking into account the journal's ranking in the year of publication, these publications amount to 120 points, thereby fully meeting the minimum requirements for this criterion, in accordance with the adopted Rules for Appointment to Academic Positions at University of Mining and Geology;

For Indicator G, the candidate has three different types of publications, which together amount to 419 points, more than double the adopted 200 points, which is the minimum requirement for this indicator under the adopted Regulations for Holding an Academic Position in the professional field of "Earth Sciences," in accordance with the "Rules for Appointment to Academic Positions at UMGS";

5. Major scientific and applied scientific contributions

Based on the scientific publications presented, published between 2012 and 2025 and reflecting the results of the scientific and applied research conducted as part of the work program for the respective projects, through the presented Summary of Scientific and Applied Contributions (Appendix 5), Assoc. Prof. A. Angelov identifies ten major contributions, which are logically substantiated by the respective publications. The majority of them, specifically seven, are related to:

- The role of microbial fuel cells based on dissimilatory microbial sulfate reduction as an approach for treating water from the mining industry contaminated with sulfates and heavy metals, with concomitant energy production;
- Multivariate analysis of the factors influencing the performance of the microbial fuel cell and identification of nitrate concentration, anolyte electrical conductivity, and temperature as the main factors limiting its efficiency;
- Treatment of mining wastewater through the skilful integration of microbial fuel cells into constructed wetlands and sedimentary ecosystems, and elucidation of the role of the phytocenosis and rhizosphere microflora on the overall efficiency of the process;
- Treatment of acidic mine water using bioelectrochemical systems based on dissimilatory microbial sulfate reduction, which not only restores the quality of the contaminated water but also demonstrates the possibility of consistent, selective, and effective precipitation of dissolved heavy metals and the potential for their subsequent recovery;
- Active and passive wastewater treatment systems for the mining industry through the complete removal of dissolved sulfates by precipitating them as ettringite or through dissimilatory microbial sulfate reduction in passive systems;
- Integration of microbial electrolysis cells in the anaerobic degradation of organic waste (activated sludge, vinasse, distillers' grains) to optimise the biomethane process and advance biogas production technology. Demonstrates the positive role of applied low external voltage and low-frequency pulsed voltage, both on the biodegradation rate of hard-to-degrade organic substrates and on the mass transfer of substrates to the biofilm and the separation of the formed products, respectively, in the operation of an anaerobic bioreactor;
- Photo-bioelectrochemical systems combining the processes of photosynthesis and electrogenesis by investigating the role of wavelength on the efficiency of oxygenic photosynthesis and the performance of the microbial fuel cell, oxygen mass transfer, and oxygen balance in a column-type bioreactor. Development and analysis of the operation of a microbial fuel cell integrating a bioreactor with sulfate-reducing bacteria in the cathode region and a photo-bioreactor with microalgae in the anode region of the cell, as a sustainable approach for the treatment of acidic mine water contaminated with heavy metals and sulfates, and the concomitant generation of electricity;

- Production of carbon nanomaterials as cathode electrocatalysts for use in bioelectrochemical systems for oxygen reduction at neutral pH; their activity at acidic and alkaline pH and their resistance to poisoning; their integration into hybrid cathodes within microbial fuel cells featuring a biofilm of sulfate-reducing bacteria in the anode compartment of the cell; the application of nanoparticles as sensors responsive to ferric ion concentration;
- Treatment of leachate from municipal solid waste through analysis and systematisation of the main factors affecting leachate quality, design of a laboratory setup and determination of the optimal treatment process for leachate based on the specified treatment parameters, as well as determination of the optimal kinetic parameters for the optimal removal of nitrogen from the treated water;
- Environmental monitoring of environmental components, enabling the identification of key pollutants, the mechanisms and processes facilitating their dissolution and transport in the environment, as well as the implementation of effective measures to reduce pollutant transport and the bioremediation of disturbed sites,
- Environmental risks associated with CO₂ storage in geological formations and identification of key risk scenarios for environmental pollution during shale gas extraction.

6. Citations of the publications by Assoc. Prof. A. Angelov

A list of citations for the scientific publications in which the candidate is a co-author has been duly attached to the documents for the competition for the academic position of “professor.” As of the date of preparation of the documents for participation in the competition, February 27, 2026, Assoc. Prof. Angelov has attached a list of 78 citations in English-language literature of scientific publications in which he is a co-author, published between 2013 and 2025. A separate list of citations is also attached, with links to the respective publications, totaling 77 entries.. It results in 395 points, which is nearly four times the minimum requirements for the academic position of “professor” in the scientific field of “*Earth Sciences*”, according to the adopted Rules of University of Mining and Geology.

The scientific publications with the most citations are:

- Bratkova S., Alexieva Z., Angelov A., Nikolova K., Genova P., Ivanov R., Gerginova M., Peneva N., Beschkov V. (2019), Efficiency of microbial fuel cells based on the sulfate reduction by lactate and glucose, *International Journal of Environmental Science and Technology*, 16(10), pp. 6145-6156 with 18 citations
- Angelov A., Bratkova S., Loukanov A., Microbial fuel cell based on electroactive sulfate-reducing biofilm, *Energy Conversion and Management* 67, 2013, 283-286, ISSN: 0196-8904. (Scopus). with 29 citations

- Loukanov, A., Angelov, A., Takahashi, Y., Nikolov, I., & Nakabayashi, S. (2019), Carbon nanodots chelated with metal ions as efficient electrocatalysts for enhancing performance of microbial fuel cell based on sulfate reducing bacteria. *Colloids and Surfaces A: Physicochemical and Engineering Aspects.*, Vol.574, 2019, Pages 52-61, ISSN 0927-7757(Scopus).

with 11 citations

These results unequivocally demonstrate not only compliance with the minimum requirements under Indicator D (*Citations or reviews in scientific publications*) for habilitation and appointment to the academic position of “professor” outlined in the *Rules for Appointment to Academic Positions at the St. Ivan Rilski University of Mining and Geology “St. Ivan Rilski,”* but also the significance of the scientific research conducted with the participation of Assoc. Prof. A. Angelov, the resulting scientific and applied contributions, and their independent evaluation by the international scientific community.

7. Evaluation of Activity Based on Indicator E, in accordance with the Rules for Appointment to Academic Positions at St. Ivan Rilski University of Mining and Geology

Supervision of a PhD candidate who successfully defended their dissertation

During the evaluation period, Assoc. Prof. Angelov was the sole supervisor (3 doctoral students) or co-supervisor (2 doctoral students) of a total of 5 doctoral students who successfully defended their dissertations in the scientific specialities “*Systems and Devices for Environmental Protection*” (4 doctoral students) and “*Water Treatment Technologies*” (1 doctoral student). Three of these doctoral students are members of the academic staff of the Departments of “*Engineering Geoecology*” and “*Mineral Processing and Recycling*” thus representing the next generation of researchers and tutors in these academic branches.

Scientific Research and Applied Activities

According to the attached report covering the period from the time of holding the academic position of “Associate Professor” until the time of preparation for participation in the competition for the academic position of “Professor” in the Scientific Field “*Earth Sciences*” at St. Ivan Rilski University of Mining and Geology, Assoc. Prof. Anatoly Angelov has participated in 26 projects, serving as principal investigator in 8 of them and as a participant in the remaining 18. The diverse range of projects carried out during this period makes a very good impression — three projects funded by the Scientific Research Fund, two projects under European programs, 4 projects under National Research Programs, 11 projects funded by the private sector, and 7 projects funded under the Regulation on the Conditions and Procedures for the Evaluation,

Planning, Allocation, and Expenditure of State Budget Funds for the Financing of Core Activities of State Universities. It is a very good testament to the skilful combination of conducting scientific research in environmental protection and restoration, and of adapting and applying its results in practice.

Funds raised for the budget through project activities

The total amount of funds raised through projects led by Assoc. Prof. A. Angelov, in accordance with the adopted evaluation criteria (E-20), corresponds to 85 points.

The evaluation of these activities under Indicator E totals 635 points, exceeding the 150 points specified in the adopted minimum requirements for the academic position of "professor," in accordance with the adopted Rules of University of Mining and Geology.

8. The Candidate's Teaching Activities

The average teaching load of Assoc. Prof. A. Angelov for the period 2021–2025 is approximately 600 hours, consisting of teaching students in both majors within the Department of Ecology and Environmental Protection and Biotechnology, at the bachelor's and master's levels, as well as from teaching students in the bachelor's and master's programs "*Gas, Fuel, and Purification Engineering and Technologies*" and "*Gas Infrastructure Management*", respectively, under Program Area 5.8. "*Exploration, Extraction, and Processing of Mineral Resources*".

From the above, it is evident:

- The technical and technological training of students through the courses taught by Assoc. Prof. A. Angelov, who is an integral part of their development as engineers upon completion of the respective degree program;
- Adapting student training to the dynamic changes in the field of ecology, market requirements, and the reorganisation of the educational process in higher education in Bulgaria over the past 5 years through the development of new courses and/or innovations in the educational process;
- The existence of a broad base of teaching hours ensures the fulfilment of the minimum teaching load for faculty members at University of Mining and Geology in the long term.

9. Conclusion.

The competition complies with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria. The candidate, Assoc. Prof. Anatoly Angelov, PhD, has organised and continued conducting in-depth research since assuming the academic position of “associate professor.” The results of this work are of a significant scientific and applied nature, as evidenced by the publications presented and their citations within the scientific community.

For this competition, I consider that the scientific and applied scientific contributions, in terms of volume and significance, are fully sufficient and meet the requirements of the Law on Academic Staff and the Regulations thereto in this area, as the quantitative indicators for the relevant criteria for holding the academic position of “professor” have been met.

As a member of the scientific jury and based on the evaluation of the academic activity (submitted scientific works, their scientific and applied significance, and engagement in the education process) of Assoc. Prof. A. Angelov, PhD, carried out after assuming the academic position of “associate professor” and in accordance with the *Regulations for Holding Academic Positions at the St. Ivan Rilski University of Mining and Geology*, I consider that these results, individually and collectively, fully meet all requirements for holding the academic position of “professor.” Based on this, I propose that **Assoc. Prof. Eng. Anatoly Angelov, PhD, to be elected to the academic position of "professor"** in professional field 4.4 "Earth Sciences", scientific speciality "Systems and Devices for Environmental Protection", Department of Engineering Geoecology at the Faculty of Geological Exploration of the University of Mining and Geology, St. Ivan Rilski, Sofia.

24.04.2026

Sofia

Signature

(Assoc. Prof. P. Georgiev)