REVIEW

for a competition for the academic position of "Professor"
in Field of Higher Education 4. Natural Sciences, Mathematics and Informatics
Professional Field 4.2. Chemical Sciences
Scientific specialty "Physical Chemistry"
Department of "Physical Chemistry", Faculty of Chemistry
for the needs of Paisii Hilendarski University of Plovdiv
announced in the State Gazette, issue 96 / 11.11. 2025

Admitted to participate in the announced competition: Assoc. **Prof. Nina Dimitrova Dimcheva, PhD**
Reviewer: Prof. Konstantin Balashev, DSc

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1. General information and brief profile of the candidate

In the announced competition for the academic position of "Professor" in the scientific specialty "Physical Chemistry", Assoc. Prof. Nina Dimitrova Dimcheva, PhD, has been admitted - a well-established scientist and long-standing lecturer at the Faculty of Chemistry of Paisii Hilendarski University of Plovdiv. The candidate completed her secondary education in 1985 at the Mathematics High School "Acad. Kiril Popov", Plovdiv. In the period 1985–1990 she studied at the Faculty of Chemistry of Sofia University "St. Kliment Ohridski", where she obtained a Master's degree with a specialization in Theoretical Chemistry and Chemical Physics. In 2001 she obtained the educational and scientific degree "Doctor (PhD)" in Physical Chemistry.

Her professional career began in secondary education, where she worked as a teacher in the period 1991–1993. Since 1993 her academic development has been permanently associated with Paisii Hilendarski University of Plovdiv, where she successively held the positions of part-time assistant (1993–1994), assistant and senior assistant (1994–2001), and chief assistant (2001–2006). In 2006 she was granted tenure as an Associate Professor in Physical Chemistry, which she has held to the present day.

In the course of her professional development, Assoc. Prof. Dimcheva carried out significant international specializations and research stays, including at the University of Lund, Sweden (2002–2003) and Ruhr University Bochum, Germany (2007–2008), where she deepened her expertise in the field of bioelectrochemistry and enzymatic biofuel cells.

Her professional activity is entirely related to teaching and research work. For more than three decades she has actively participated in the education of students, in the development and improvement of curricula (including the courses "Physical Chemistry", "Electrochemical Methods of Analysis", and "Biocatalysis and Bioelectrochemistry"), and in conducting scientific research. The candidate has proven experience in training young researchers, successfully supervising PhD students and diploma students.

Assoc. Prof. Dimcheva has built a distinguished scientific and organizational profile. Since 2018 she has been Head of the Department of "Physical Chemistry" at Paisii Hilendarski University of Plovdiv, and since 2019 she has headed the Biosensors Laboratory within the Center of Competence PERIMED. Her scientific authority is evidenced by her service as an expert on the Standing Scientific Expert Commission for Chemical Sciences at the National Science Fund, as well as her role as a guest editor for leading international journals.

The career of Assoc. Prof. Dimcheva is characterized by consistency and continuity, with a clearly defined specialization in cutting-edge areas such as biocatalysis, electrocatalysis, and nanomaterials.

2. Description of the submitted materials

The candidate has submitted a complete set of documents which comply with, and by a number of indicators exceed, the requirements of the Academic Staff Development Act, its Implementing Regulations, and the internal regulations of Paisii Hilendarski University of Plovdiv.

For participation in the competition, Assoc. Prof. Nina Dimitrova Dimcheva, PhD, presents a total of 45 scientific works published in the period 2006–2025, distributed as follows: 40 scientific articles, 2 book chapters, 2 laboratory manuals, and 1 patent for an invention.

A significant part of the publications has been published in reputable international scientific journals indexed in Web of Science and Scopus. Particularly noteworthy is the fact that 31 of the submitted articles are published in journals with an impact factor (IF), with a total impact factor of 83.653.

The candidate's personal h-index is 17, which is an objective indicator of the high visibility, recognition, and scientific significance of her research.

The submitted habilitation report contains an analytical and systematized summary of the scientific contributions and by its nature is equivalent to a monographic work. It is based on 6 thematically related publications, 5 of which are in journals ranked in quartiles Q1–Q3.

The citation report confirms a significant international impact of the scientific output. A detailed quantitative analysis of compliance with the minimum national requirements is presented in the next section of the review.

3. Compliance with the minimum national requirements

From the submitted report on compliance with the minimum national requirements (in accordance with of the Academic Staff Development Act, its Implementing Regulations, and the internal regulations of Paisii Hilendarski University of Plovdiv), it is evident that the candidate not only meets but also significantly exceeds the statutory criteria for the academic position of 'Professor' in Professional Field 4.2. Chemical Sciences.

The indicators by the respective groups demonstrate a balanced and strongly expressed profile, including substantial scientific output, high citation impact, active teaching activity, and concrete scientific and applied results.

Compliance with the minimum national requirements by groups of indicators is presented in the following table:

Group of indicators	Content	Minimum requirements for "Professor"	Points of Assoc. Prof. Dimcheva
A	Indicator 1 (Dissertation for the PhD degree)	50 pts	50 pts
B	Indicator 2 (Dissertation for the DSc degree)	–	–
V	Indicators 3 or 4 (Publications equivalent to a habilitation work)	100 pts	110 pts
G	Sum of indicators 5–10 (Publications outside the habilitation set)	200 pts	590 pts
D	Indicator 11 (Citations)	100 pts	120 pts
E	Indicators 12 and following (projects, supervision, patents, textbooks, etc.)	150 pts	248 pts

TOTAL REQUIRED POINTS: 600 pts
TOTAL POINTS OBTAINED: 1118 pts

As seen from the table, the total number of points of Assoc. Prof. Dimcheva is 1118, which is almost twice the minimum required 600 points.

Particularly impressive is the significant surplus in Group G, related to scientific publications outside the habilitation set, as well as in Group E. This provides convincing evidence of her active project work, supervision of young researchers, and the successful implementation of scientific and applied results, including a patent.

The presented data allow for the unequivocal conclusion that the candidate fully satisfies and significantly exceeds the minimum national requirements for the academic position of "Professor".

4. General characteristics of the research activity and contributions

The research activity of Assoc. Prof. Nina Dimcheva is focused on topical and emerging challenges in the fields of electrochemistry, electrocatalysis, heterogeneous biocatalysis, and bioelectrochemistry. The presented publications cover interdisciplinary topics at the interface of materials science, electrochemical analysis, and modern biosensor technologies. Based on the topics, content, and goals of these works, the

candidate's research can be grouped into two main, logically interrelated directions: electrocatalytic and bioelectrochemical.

4.1. Electrocatalytic direction

A substantial fundamental and applied contribution in this direction is the development and optimization of methods for the electrochemical deposition of bimetallic nanostructures (Pd–Pt and Pd–Au) on various electrode surfaces, including meso- and microporous graphite (works No. 4, 7, 11, 18, 29, 31), carbon felt (No. 33), and glassy carbon (No. 5). A clear quantitative relationship has been established between the composition of the plating electrolyte and the chemical composition of the resulting alloys; furthermore, the formation of Pd–Pt and Pd–Au alloys has been conclusively demonstrated via X-ray diffraction (XRD).

Using scanning electron microscopy (SEM) and atomic force microscopy (AFM), the surface morphology of these nanostructures was investigated, revealing that their size and shape are directly dependent on the proportion of the second metal component (work No. 11). It was also found that decreasing the size of the catalytically active phase leads to a significant increase in electrocatalytic activity during the reduction of hydrogen peroxide and oxygen. Notably, Pd–Pt deposits with a 70:30 ratio exhibit particularly high activity (works No. 4, 7, 11).

Original methods have also been developed for the electrochemical deposition of monometallic Rh (works No. 17, 26, 28) and Au (No. 2, 3, 10, 12, 14, 30, 35, 36) structures. It has been shown that the nature of the substrate material significantly influences electrocatalytic activity; for instance, Rh deposition on glassy carbon achieved double the sensitivity and a nearly three-fold wider linear range compared to graphite substrates.

In a separate, highly applied series of studies, a composite material based on graphitic carbon nitride doped with Co_2O_3 and stabilized with Nafion was developed (works No. 19, 23). This material exhibits high catalytic activity in peroxide reduction and has been successfully implemented for determining the peroxide value of vegetable oils, with analytical reliability fully comparable to the standard method prescribed by the Bulgarian State Standard (BDS).

4.2. Heterogeneous biocatalysis and bioelectrochemistry

The second main direction comprises extensive studies related to the development of methods for immobilization of a broad range of enzymes (glucose oxidase, xanthine oxidase, urease, acetylcholinesterase, catalase, laccase, ascorbate oxidase, myoglobin) on unmodified and modified electrode surfaces. The goal is the creation of highly efficient electrochemical biosensors of the first and third generation.

Four types of first-generation biosensors have been successfully constructed - for detection of glucose, xanthine, urea, and pesticides (works No. 2, 4, 5, 7, 11, 18, 24, 26) - which are characterized by high selectivity and very low limits of detection. The biosensor for L-ascorbic acid (works No. 3, 10) deserves special attention; it demonstrates excellent sensitivity, a low working potential (0.15 V), and outstanding operational stability (over 7 months). This success has been materialized in a granted patent for an invention (Patent No. 66837 B1: "Bio-electrocatalytic method for quantitative analysis of L-ascorbic acid").

A very significant fundamental contribution in this direction is the experimental demonstration of direct electron transfer (DET) in immobilized enzymes and proteins (works No. 9, 10, 30, 35). Building on these results, Assoc. Prof. Dimcheva and her team developed a conceptual enzymatic biofuel cell using lactose as a fuel and atmospheric oxygen as an oxidant (work No. 16) - an achievement with high potential for green energy.

In parallel with the main directions, separate publications examine the corrosion resistance of metal coatings (works No. 20, 21, 22, 34, 37), as well as specific kinetic and bioanalytical aspects of enzyme systems (works No. 27, 38).

4.3. Summary

The research activity of Assoc. Prof. Nina Dimcheva is characterized by clearly defined thematic continuity, high methodological culture, and a distinct interdisciplinary profile. Her studies consistently build upon fundamental principles in electrochemistry and bioelectrochemistry and transform them into applicable analytical and energy systems. On the basis of this overall research profile, the specific scientific and applied contributions can be formulated and are systematized in the next section.

5. Main scientific and scientific-applied contributions

Based on the performed analysis, the scientific results of Assoc. Prof. Nina Dimcheva can be systematized into three main groups: *fundamental, scientific-applied,* and *methodological.*

5.1. Scientific (fundamental) contributions

The fundamental contributions are related to expanding knowledge about the mechanisms and regularities in electrocatalytic and bioelectrochemical processes.

Dependencies between the composition, structure, and morphology of bimetallic nanostructures and their catalytic activity have been clarified, and the size-dependent electrocatalytic efficiency of nanostructured noble metals has been demonstrated.

The role of the electrode substrate has been formulated as an active factor in the catalytic process, contributing to a deeper understanding of interfacial phenomena.

Direct electron transfer between immobilized enzymes and the electrode surface has been demonstrated - a result of substantial importance for the development of bioelectrochemistry.

The concept of using metal nanostructures as nanozymes has been substantiated, expanding the classical notions of biocatalysis.

5.2. Scientific-applied contributions

New electrochemical sensing platforms have been developed for the determination of biologically and analytically significant compounds, characterized by high sensitivity and low detection limits.

A patented method for quantitative analysis of L-ascorbic acid has been realized, demonstrating the practical applicability of the obtained results.

Functional composite materials have been created with proven analytical efficiency for determining peroxide value, with potential for implementation.

An enzymatic biofuel cell has been developed, demonstrating the possibility of applying bioelectrochemical systems in alternative energy.

5.3. Methodological contributions

Experimental approaches have been developed and validated for controlled electrochemical synthesis of nanostructured catalytic materials.

Modern physicochemical methods have been integrated for comprehensive characterization of functional surfaces.

Protocols have been optimized for stable enzyme immobilization and for electrochemical determination of biocatalytic activity.

The possibilities for electrochemical assessment of corrosion processes in metal coatings have been expanded.

5.4. Summary assessment

The scientific and applied contributions of Assoc. Prof. Nina Dimcheva are clearly identifiable, internally cohesive, and logically consistent. Her work advances fundamental understanding in electrochemistry and bioelectrochemistry while providing developments with significant applied potential. A defining characteristic of her research is the sustained transition from fundamental analysis to technologically oriented applications.

6. Impact of the scientific results in the literature (Citation impact)

The scientific output of Assoc. Prof. Nina Dimcheva is characterized by significant international citation impact, which is an objective indicator of the relevance, scientific value, and recognition of her research.

According to the submitted citation report, numerous independent citations of her works have been registered in authoritative international journals indexed in Web of Science and Scopus.

It is particularly noteworthy that her results are cited in journals with high impact factor and leading positions in the respective scientific fields, including Materials Horizons, ACS Catalysis, Journal of Alloys and Compounds, Clinical Chimica Acta, ACS Biomaterials Science and Engineering, Nanoscale, Analytical Chemistry, Biosensors and Bioelectronics, Journal of Power Sources, ACS Applied Materials & Interfaces, and others.

The citations cover a broad thematic range - from fundamental aspects of electrocatalysis and nanostructured noble metals to applied developments in biosensing, electrochemical analysis, and bioenergy. This indicates that the candidate's scientific results are not isolated within a narrow thematic context but are actively integrated into contemporary international scientific discourse.

It is also noteworthy that a significant portion of her publications serve as primary reference sources in major review papers and methodological developments. This clearly demonstrates her sustained impact on the evolution of her respective scientific fields.

The presented scientometric indicators (h-index 17, a significant number of citations, and publications in journals with impact factor) confirm the high scientific visibility and international recognition of her research activity.

On the basis of these data, a categorical conclusion can be made that the scientific results of Assoc. Prof. Nina Dimcheva have a lasting and significant impact on the international scientific literature.

7. Teaching and pedagogical activity

The teaching activity of Assoc. Prof. Nina Dimcheva represents a substantial and sustained component of her academic career. She is a long-standing lecturer at the Faculty of Chemistry of Paisii Hilendarski University of Plovdiv, actively participating in the education of students in bachelor's and master's programs and making an overall contribution to the development of the educational process.

According to the submitted official report on teaching workload for the period 2019–2025, the total volume of teaching activity converted to exercise hours amounts to 2504 hours. This indicator evidences a high and sustained workload characteristic of a lecturer with an established profile and a leading role in the department. During the period considered, Assoc. Prof. Dimcheva delivered lecture courses in "Physical Chemistry" (Parts I and II), "Electrochemical Methods of Analysis", and "Biocatalysis and Bioelectrochemistry", as well as seminar and laboratory classes related to these disciplines. Her teaching activity covers students from the programs "Chemistry", "Medical Chemistry", "Chemical Analysis and Quality Control", "Chemistry and Physics", "Biology and Chemistry", "Computational Chemistry", as well as full-time and part-time (distance) forms of study.

It is particularly important that she combines the instruction of the fundamental discipline 'Physical Chemistry' with highly specialized courses in electrochemistry and bioelectrochemistry. This creates a seamless bridge between students' foundational preparation and the contemporary scientific frontiers of her own research. The clear integration of her scientific results into her teaching curriculum is a distinctive hallmark of academic maturity and a truly modern university approach.

The candidate has also made a significant contribution to the development and updating of curricula. She is an initiator and author of courses approved by the Faculty Council, including "Electrochemical Methods of Analysis" as a specialized compulsory course and "Biocatalysis and Bioelectrochemistry" as an elective course. This demonstrates an active role in modernizing teaching content and introducing up-to-date scientific topics into the educational process.

An important element of her pedagogical activity is participation in the development of university teaching materials. She is a co-author of "Exercises and Problems in Applied Physical Chemistry" (2007), which includes sections on biocatalysis and electrocatalysis, as well as "Laboratory Manual for Physical Chemistry and Colloid Chemistry" (second revised and expanded edition, 2017). These publications have lasting importance for the practical training of students and for standardizing laboratory work at the faculty. Throughout her academic career Assoc. Prof. Dimcheva has actively participated in supervising diploma students and PhD students, involving students in real research tasks and project work. In this way, she contributes not only to education but also to the formation of young researchers in electrochemistry and bioelectrochemistry.

In summary, the teaching and pedagogical activity of Assoc. Prof. Nina Dimcheva is characterized by high intensity, substantial depth of content, and an organic link with her research work. She demonstrates the ability to maintain a high level of fundamental training in physical chemistry while introducing students to contemporary interdisciplinary directions. This balanced profile fully corresponds to the requirements for the academic position of "Professor".

8. Project activity

The project activity of Assoc. Prof. Nina Dimcheva is intensive, long-term, and thematically closely connected with her scientific specialization in electrochemistry, bioelectrochemistry, and applied catalysis. It includes both participation and leadership in nationally and internationally funded research projects, implemented in a competitive environment and financed by the National Science Fund, European Union operational programs, and institutional funds.

The candidate is the principal investigator of two projects funded by the National Science Fund at the Ministry of Education and Science. The project "Bioelectrochemical methods for rapid, selective and sensitive control of food quality and safety (FOQUS)" (DDVU-02/38, 2011–2014) is aimed at developing innovative analytical approaches for food control using bioelectrochemical systems. The second project led by her - "Chemo-enzymatic catalysis in non-aqueous media (ChEnCat)" (KP-06-N39/8, 2019–2025) - with a total budget of BGN 120,000, represents a significant contribution to research on combined catalytic systems integrating chemocatalysis and enzymatic catalysis in non-traditional media. Leading such projects evidences high scientific competence, organizational capacity, and trust from the funding institutions.

Her participation in European infrastructure and strategic projects is particularly significant. In the period 2018–2023 she was a researcher and leader of the "Biosensors" work package within the Center of Competence "PERIMED" (BG05M2OP001-1.002-0005-C03), funded under OP Science and Education for Smart Growth. This activity continues with her participation in "PERIMED-2" (BG16RFPR002-1.014-0007, 2025–2029), where she again has a leading role in the "Biocatalysis and biosensors" direction. These projects are related to building research infrastructure and implementing personalized innovative solutions in medicine, which highlights the high applied value of her developments.

Assoc. Prof. Dimcheva also participates in a project funded under the National Recovery and Resilience Plan (BG-RRP-2.004-0001-C01, "Digital sustainable ecosystems"), which demonstrates her involvement in interdisciplinary research with technological and social orientation. She has also participated in the project "Vita plus Biodesign and Bioeconomy" (2021–2022) under the Research Fund of Plovdiv University, aimed at implementing bioeconomic models and innovative biotechnological solutions.

In parallel, the candidate has been a participant in a number of national projects under the National Science Fund, including developments related to electrochemical biosensors for determination of organophosphorus pesticides (2009–2012) and sediment bioelectrochemical systems for bioremediation and environmental monitoring (NSF E02/14/2014). In an earlier period she also participated in institutional projects of Plovdiv University aimed at developing research infrastructure and creating new materials and technologies.

The project activity of Assoc. Prof. Dimcheva spans the period from 2007 to the present and demonstrates sustainability, thematic consistency, and an ability to integrate into large research consortia. The combination of leadership functions with an active research role in internationally funded structures testifies to a high level of scientific autonomy and managerial competence, as expected from a candidate for the academic position of "Professor".

In summary, Assoc. Prof. Nina Dimcheva, PhD, has participated in more than 12 research projects, including 2 as principal investigator under the National Science Fund, 3 with European funding, as well as a number of national and institutional developments, which convincingly demonstrates sustained project activity and proven organizational capacity.

9. Critical remarks and recommendations

Based on a thorough analysis of the submitted materials, I find no weaknesses, omissions, or inconsistencies in the research, teaching, or project activities of Assoc. Prof. Nina Dimcheva.

Her scientific output is distinguished by clearly outlined thematic continuity, methodological rigor, a high degree of interdisciplinarity, and a pronounced scientific and applied potential. The achieved results have been published in authoritative international journals with high impact factor, possess significant citation impact, and testify to the candidate's sustained and recognizable presence in contemporary directions of electrochemistry and bioelectrochemistry.

There are no grounds for critical remarks regarding the candidate's scientific or pedagogical contributions.

As a well-intentioned recommendation for her future academic development, I would suggest expanding her established research directions by recruiting new PhD students and young researchers. Furthermore, I recommend intensifying the technology transfer and commercialization of her novel biosensor methodologies.

My overall assessment is entirely positive and unequivocally supportive of the candidacy.

10. Personal impressions

I have known Assoc. Prof. Nina Dimcheva for many years, as our academic and professional paths began around the same time. Over the years, I have had the opportunity to engage with her at numerous scientific forums, conferences, and academic meetings. Our interactions have included in-depth discussions on research topics in electrochemistry and the application of cutting-edge physicochemical methods.

My impressions of Assoc. Prof. Dimcheva are of a disciplined, thorough, and principled researcher with a clearly defined professional profile and sustained scientific interests. In scientific discussions, she demonstrates sharp analytical thinking, high expert competence, and a capacity for rigorous critical reasoning. Particularly valuable is her openness to interdisciplinary approaches - a fact I can confirm through the lens of my own scientific research. Furthermore, her successful integration of modern techniques, such as Atomic Force Microscopy (AFM), for the precise characterization of functional electrode surfaces, further testifies to her methodological versatility and modern scientific outlook.

As a colleague she is distinguished by high academic ethics, principled conduct, and constructive professional communication. My personal impressions fully correspond to the objective results presented in this procedure.

CONCLUSION

The set of documents and scientific works submitted by Assoc. Prof. Nina Dimitrova Dimcheva, PhD, not only fully satisfies but also substantially exceeds the regulatory requirements of ZRASRB, PPZRASRB, and the internal regulations of Paisii Hilendarski University of Plovdiv for the academic position of "professor".

Her research activity is characterized by thematic continuity, high scientific value, significant international impact, and a clearly expressed innovation potential. Her teaching and project activity complement and confirm her profile as an established scientist and academic leader.

Based on the arguments presented above, I give my **categorically positive** evaluation and **strongly recommend** that the esteemed Scientific Jury vote **'FOR'** and propose to the Faculty Council of the Faculty of Chemistry at Paisii Hilendarski University of Plovdiv to elect **Assoc. Prof. Nina Dimitrova Dimcheva**, **PhD**, to the academic position of **'Professor'** in the Field of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.2. Chemical Sciences (Scientific specialty: Physical Chemistry).

Date: 04 March 2026

Sofia

Reviewer: ……

/Prof. Konstantin Balashev, DSc/