

REVIEW



on competition for a professor position
in scientific direction 4.2 Chemical Sciences, specialty Electrochemistry
announced in the State Gazette, Issue No. 44, dated May 14, 2026
with candidate Jenia Stefanova Georgieva, Ph.D., Assoc. Prof.
Reviewer: Vesela Tsyetanova Tsakova-Stancheva, D.Sc., Prof.

1. General Information and brief biographical details about the candidate.

Associate Professor Georgieva was born in November 1965 in Sofia. She graduated from the Technical School of Industrial Chemistry in Sofia in 1985. She received her higher education at the University of Chemical Technology and Metallurgy, graduating in 1993 with a degree in "Electrochemistry and Corrosion." She began working at the Institute of Physical Chemistry (IPC) of the Bulgarian Academy of Sciences (BAS) in 1985 as a chemical technician, and subsequently, after completing her higher education, was appointed to the position of "chemist." She was elected as a research associate at the Institute in 1999 and successively held the positions of Research Associate III–I and Assistant Professor. In 2008, she defended her dissertation on "Chemical Deposition of Ni-Cu-P and Ni-Sn-P Coatings" to earn the academic and scientific degree of "Doctor" in the scientific specialty 01.05.05—Electrochemistry. (The diploma from the Higher Attestation Commission was issued in January 2009.) She was elected associate professor in 2011. Throughout her more than 40-year professional career, Zh. Georgieva has worked at IPC-BAS. She is a long-standing member of the Institute's Scientific Council and served as the Institute's Scientific Secretary from 2017 to 2024. She teaches in the "Applied Electrochemistry" course at the Bulgarian Academy of Sciences' Graduate School.

Jenia Georgieva specialized in the field of electro- and photoelectrocatalysis at Aristotle University of Thessaloniki and maintains a long-standing collaboration with scientists from that university. She has also been involved in long-standing collaborative research with teams from the Free Universities of Wallonia and Flanders.

2. Description of the submitted materials

Assoc. Prof. Georgieva is participating in the competition with a total of 20 research papers, eight of which are presented as equivalent to a habilitation thesis. The research papers have been published in renowned scientific journals in the field of electrochemical and catalytic research, such as Journal of

Electroanalytical Chemistry, Journal of Solid State Electrochemistry, Applied Catalysis B, Catalysis Today, RSC Advances, and others.

For the competition for the position of professor, Assoc. Prof. Georgieva has submitted evidence organized by groups of indicators in accordance with the minimum requirements of IPC-BAS, as adopted by the institute's Scientific Council (Appendix No. 1 of the Regulations on the Conditions and Procedures for Awarding Academic Degrees and Appointing Academic Positions at the Institute of Physical Chemistry—BAS), as follows:

Group A Indicators

Dissertation on the topic "Chemical Deposition of Ni-Cu-P and Ni-Sn-P Coatings," defended in 2008 and based on five publications. (50 points)

Group B Indicators

Eight scientific papers published between 2013 and 2025 are presented as equivalent to a habilitation thesis, six of which appeared in Q1-ranked journals and two in Q2-ranked journals. (Total: 190 points with a minimum requirement of 100 points)

Group G Indicators

In addition to the publications under Indicator B, twelve more publications are presented, published between 2012 and 2019, of which seven appeared in Q1-ranked journals, one in a Q2-ranked journal, two in Q3-ranked journals, and two in publications with SJR but no IF. (Total: 245 points, with a minimum requirement of 220 points)

The publications under Indicators B and G were published after the candidate's habilitation as an "associate professor" and do not duplicate those used to obtain the academic degree of "doctor" or in the competition for the position of "associate professor."

Group D Indicators

A list of a total of 546 citations (excluding self-citations) of the works with which the candidate is participating in the competition has been submitted. All scientific works have citations; the eight publications presented as equivalent to a habilitation thesis account for 210 of these citations. (Total: 1,092 points, with a minimum requirement of 120 points.)

Group E Indicators

Assoc. Prof. Georgieva has supervised one doctoral student who successfully defended her dissertation. She has participated in teams working on four national projects and five international

research projects with the Walloon and Flemish Universities of Brussels, funded by the academic Equivalent non-monetary exchange with Belgium. She served as team leader for IPC-BAS on a national project funded by the Bulgarian National Science Fund, carried out jointly with the Institute of Catalysis at the Bulgarian Academy of Sciences and Sofia University "St. Kliment Ohridski." During the periods 2016–2019 and 2022–2025, she led the Bulgarian team on two projects with Aristotle University of Thessaloniki, funded by the the academic Equivalent non-monetary exchange with Greece. In connection with these activities under Indicator E, she scored 317 points, with a minimum requirement of 150 points.

The documents submitted for the competition have been carefully prepared and provide supporting evidence for all criteria. The checklist for meeting the minimum requirements has been accurately completed. The candidate meets all requirements and, for some criteria (B, D, and E), significantly exceeds the minimum national requirements and the requirements set forth in the Regulations of the Institute of Physical Chemistry—Bulgarian Academy of Sciences. All submitted publications are relevant to the competition's subject matter and are accepted for review.

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

The works submitted for the competition are original studies in the field of the synthesis, physicochemical and electrochemical characterization, and evaluation of the catalytic properties of nanostructured catalytic materials for applications in fuel cells, electrolyzers, and photoelectrochemical systems. Three of the submitted works are review articles, two of which are in the field of the synthesis of electrocatalysts via galvanic replacement (Publication 7.8) and via photoelectrocatalytic oxidation of organic substances under the action of visible light (Publication 7.9). The third review article summarizes research on currentless deposition of Turner alloys—Ni–W–P, Co–W–P, and Ni–Zn–P (Publication 7.10)—which is related to Assoc. Prof. Georgieva's work prior to her habilitation and during her tenure as an associate professor.

In the original studies submitted for the competition, a wide range of electrochemical and physicochemical methods was used for the synthesis and characterization of the resulting catalytic materials. This includes cyclic and linear scanning voltammetry, chronoamperometry, electrochemical impedance spectroscopy, scanning and transmission electron microscopy, energy-dispersive spectroscopy, X-ray diffraction analysis, X-ray photoelectron spectroscopy, and small-angle X-ray scattering. It is precisely this comprehensive approach to characterizing the synthesized catalysts that accounts for the large number of co-authors in the presented publications.

All publications are co-authored by a total of four to twelve authors. The larger teams are linked to collaborations with research groups primarily from Belgium and Greece, which have provided

opportunities—partly unavailable in Bulgaria—to measure certain characteristics of nanostructured catalysts. In four of the publications, Assoc. Prof. Georgieva is the first author, and in five, she is the second author, which attests to her significant role in carrying out this research.

Most of the catalysts developed in the candidate's research are platinum-based, using various supports—carbon powder (Vulcan XC72R), oxide supports (titanium dioxide and tungsten trioxide), or composite supports consisting of carbon and oxides of titanium or tungsten. As the research progressed, the catalytic systems became more complex. Initially, “core-shell” catalysts were synthesized with a core consisting of certain transition metals, such as Cu or Ni (Publications 4.1–4.4 and 7.12), and subsequently Co (publication 4.8). Two other studies (publications 4.5 and 4.6) focused on the preparation of oxide catalysts consisting of IrO_2 , deposited on powdered TiO_2 (Degussa 25), which also allowed for the investigation of photoelectrochemical processes. A further advancement of the catalytic systems involved the deposition of Pt and bimetallic Pt(Cu), Pt(Ni), and Pt(Co) particles onto oxide substrates of TiO_2 , WO_3 , or a TiO_2/WO_3 composite (Publications 4.7, 7.1, 7.2, 7.4–7.6, 7.11). Electrocatalytic reactions involving methanol oxidation, oxygen reduction, and oxygen evolution, as well as photoelectrochemical methanol oxidation, have been studied. The main focus of the research is to elucidate the relationship between the structure, composition, and morphology of the nanocatalysts and their electrocatalytic activity and stability. In all cases, the catalytic activity of the newly synthesized nanostructured materials is compared to that of commercially available catalysts currently in use.

Assoc. Prof. Georgieva's research activities involve close collaboration with leading research groups from Belgium and Greece. As part of several consecutive projects with the two Free Universities of Brussels—the Flemish and Walloon—in Belgium, research has been conducted on the electrochemical synthesis, modification, and characterization of nanostructured materials. Assoc. Prof. Georgieva has maintained a long-standing and highly fruitful collaboration with the University of Thessaloniki on topics closely related to the research covered in the publications submitted for this competition.

From 2016 to 2019, at the request of and with funding from the Center of Electrochemical Surface Technology in Austria, she supervised a full-time doctoral student who successfully defended his dissertation in 2023. Assoc. Prof. Georgieva serves as a lecturer in the “Applied Electrochemistry” course offered by the Bulgarian Academy of Sciences' Doctoral School.

4. Major scientific and applied scientific contributions.

The major contributions of the works submitted for the competition will be considered as a whole, without singling out those presented as equivalent to a habilitation thesis. The contributions can be

divided into two main groups: those related to the synthesis and characterization of catalysts, and those related to their electrochemical activity in electro- and photoelectrocatalytic processes.

4.1. Synthesis and characterization of nanostructured catalysts

4.1.1. Using three different approaches for the synthesis of the copper precursor (chemical reduction of copper on a carbon support, electroless deposition of copper on a carbon support, and the use of copper powder) and through subsequent galvanic replacement, core-shell bimetallic catalysts were obtained (a transition-metal core and a Pt-enriched shell) (Publications 4.1, 4.3, and 7.12). Similarly, through electroless deposition of Ni (Publication 4.2) or Co (Publication 4.8) onto a carbon support and subsequent galvanic replacement, Pt(Ni) and Pt(Co) bimetallic catalysts, respectively, with a Pt-enriched outer shell were obtained. In all cases, the structure of the resulting catalytic particles has been elucidated in detail. The applied method of galvanic replacement with platinum, which occurs predominantly on the surface of the transition metal particles, makes it possible to reduce the consumption of precious metal in the production of platinum catalysts while simultaneously modifying the electronic properties of the platinum.

4.1.2. Through a combination of photodeposition of Cu onto a semiconductor oxide substrate, powdered TiO₂ (Publications 7.4 and 7.5), or a solid WO₃/TiO₂ substrate (Publication 7.6), and following galvanic replacement of Cu with Pt, platinum catalysts were obtained, revealing nearly complete replacement of the transition metal with platinum and the presence of specific interactions between the metal phase and the oxide support.

4.1.3. A low-temperature method has been developed for the preparation of highly dispersed catalysts from IrO₂ nanoparticles deposited directly onto powdered TiO₂, based on photochemical reduction under the influence of ultraviolet light (Publications 4.5 and 4.6). This method allows for a reduction in the Ir content compared to commercial iridium catalysts.

4.1.4. An original, environmentally friendly method has been proposed for doping titanium dioxide nanostructures with B and N, in which boron and nitrogen atoms occupy primarily interstitial sites in the crystal lattice. As a result of this process, additional electronic levels are formed in the band gap of TiO₂ (Publication 7.3).

4.2. Electrochemical activity for electro- and photoelectrocatalytic processes

4.2.1. It has been established that platinum catalysts obtained by galvanic replacement of Cu or Ni, deposited on a carbon support or mixed with a carbon support, exhibit better mass activity for the methanol oxidation reaction than a commercial platinum catalyst (Publications 4.1 and 4.2).

4.2.2. The intrinsic and mass catalytic activities for methanol oxidation of platinum catalysts prepared on TiO_2 via photochemical deposition of Cu and galvanic replacement of Pt were compared with those of a commercial platinum catalyst. A significant (six-fold) increase in the intrinsic catalytic activity of the prepared catalysts was observed, attributed to the specific interaction of the catalytic phase with the titanium dioxide support (Publications 7.4 and 7.5).

4.2.3. It has been established that the approaches used to combine transition metals with platinum and the addition of semiconductor (oxide) supports into the catalytic systems leads to a reduction in the CO poisoning effect on the catalysts due to the lower binding energy of carbon monoxide and facilitated oxidation of reaction intermediates (Publications 4.1, 4.3, 7.2, 7.4, 7.12)

4.2.4. It has been shown that a platinum catalyst obtained by chemical deposition of copper onto a carbon support followed by galvanic replacement of the copper with platinum exhibits, under certain conditions, more than 50% higher catalytic activity for the oxygen reduction reaction compared to a commercial platinum catalyst (Publication 4.4).

4.2.5. It has been shown that the addition of a powdered carbon filler to a Pt/TiO_2 catalyst leads to increased stability for the photooxidation of methanol upon irradiation with ultraviolet light (Publication 4.7).

4.2.6. It has been found that combining platinum with a photosensitive oxide phase (WO_3) leads to a threefold increase in the intrinsic catalytic activity for the photoelectrochemical oxidation of methanol due to the role of photogenerated holes and oxygen-containing species in the removal of adsorbed carbon monoxide (Publication 7.1).

4.2.7. It has been shown that $\text{IrO}_2/\text{TiO}_2$ catalysts exhibit enhanced activity for the oxygen evolution reaction (compared to an IrO_2 catalyst), which is attributed to the interaction between the two oxides and the high dispersion of the iridium phase. Improved stability of the bi-oxide catalyst has also been established, which enables its application in long-term water electrolysis (Publications 4.5, 4.6).

4.2.8. An improvement in photoelectrochemical activity was achieved upon irradiation in the ultraviolet and visible light regions of TiO_2 nanotubes doped with boron and nitrogen due to more efficient separation of the photogenerated carriers and inhibition of the recombination process (Publication 7.3).

The candidate's scientific contributions relate to the development of new approaches for producing nanostructured electrocatalytic materials with reduced precious metal content. Synthesis methods based on the galvanic replacement of transition metals with platinum have been extended through the use of oxide supports and photochemical processes, leading to a highly dispersed catalytic phase

with improved catalytic activity and stability. Particular attention is paid to metal-oxide interactions, which modulate the electronic properties of the resulting composite materials and are crucial for their catalytic activity and stability. The results obtained contribute to the development of a fundamental understanding of the role of metal-metal and metal-oxide interactions in electro- and photoelectrocatalytic processes. Overall, the candidate's scientific contributions relate to the expansion of existing knowledge, leading to potential practical applications with the possibility of generating economic benefits.

5. Impact of the candidate's scientific publications in Bulgarian and international literature.

The publications by Assoc. Prof. Georgieva, with which she is participating in the competition, have been cited 546 times. Noteworthy are the original work 7.3, which has 59 citations, and the review article 7.8, with 121 citations. According to Scopus data, the candidate's total number of citations is 1,607, and Assoc. Prof. Georgieva's Hirsch index is 25. The high citation rate of Assoc. Prof. Georgieva's publications reflects the high regard in which they are held by the international scientific community and is an indisputable testament to their relevance and significance.

6. Critical comments and recommendations regarding the candidate's scientific works.

I have no comments or recommendations regarding the scientific works presented. I would just like to note that the contributions outlined by the candidate could be organized according to the type of catalytic materials, so as to clearly trace the sequential optimization of the catalytic systems and the resulting positive effects on their electrocatalytic and photoelectrocatalytic properties.

I would recommend that Associate Professor Georgieva draw on her accumulated experience and high level of professionalism to strengthen her research activities by continuing to combine the resources available at the Institute of Physical Chemistry with those of partner research groups in Bulgaria and abroad.

7. The reviewer's personal impressions of the candidate.

I have known Assoc. Prof. Georgieva since she joined the IPC-BAS in 1985. I have followed her development and growth throughout all stages of her scientific career. Thanks to her work in one of the consistently strong research groups at the Institute, led for many years by Prof. Stefan Argyanov, she has developed as a scientist with high standards for scientific work and the quality of research experiments. I believe that her accumulated experience and high level of professionalism make her a particularly valuable researcher for the team and the scientific activities of the Institute of Physical Chemistry.

CONCLUSION

A review of the documents submitted by Assoc. Prof. Georgieva in the competition for the position of professor shows that she is a fully established, highly qualified specialist in the field of electrochemical materials science with significant contributions to the synthesis of nanostructured catalysts with applications in electro- and photoelectrocatalytic processes for fuel cells, electrolyzers, and photoelectrochemical systems.

In terms of volume, the quality of her scientific and applied contributions, and scientific metrics, Assoc. Prof. Georgieva fully meets and even significantly exceeds the legal requirements and those of the Regulations on the Conditions and Procedures for Holding Academic Positions at the Institute of Physical Chemistry—Bulgarian Academy of Sciences for the academic position of “PROFESSOR.” Based on all of the above, I strongly recommend that the esteemed members of the Scientific Jury award Assoc. Prof. Dr. Jenia Stefanova Georgieva the academic position of “PROFESSOR” in Scientific direction 4.2 Chemical Sciences, specialty Electrochemistry, for the needs of the Department “Electrochemistry and Corrosion” at IPC-BAS.

Date: September 22, 2026

Reviewer:



/Prof. Vessela Tsakova, D.Sc./