

## OPINION

on the competition for the academic position of “Professor” in professional field

4.2. Chemical Sciences, scientific specialty “Electrochemistry”

for the needs of the “Electrochemistry and Corrosion” Section,

announced in State Gazette No. 44 / 14.05.2026

with the sole candidate: Assoc. Prof. Dr. Jenia Stefanova Georgieva

Chair of the Scientific Jury: Prof. Dr. Maria Hristova Petrova

### **1. General characteristics of the candidate’s research and research-and-applied research activities**

Jenia Stefanova Georgieva graduated in 1993 from the Higher Institute of Chemical Technology – Sofia, specializing in “Electrochemistry and Corrosion”. Since 1999, she has worked at the Institute of Physical Chemistry “Acad. R. Kaishev” – BAS, in the “Electrochemistry and Corrosion” Section, where in 2008 she defended her doctoral dissertation entitled “Chemical Deposition of Ni-Cu-P and Ni-Sn-P Coatings”. In 2011, she was elected Associate Professor at the Institute of Physical Chemistry “Acad. R. Kaishev” – BAS.

For the competition for the academic position of “Professor”, Assoc. Prof. Dr. J. Georgieva has submitted a total of 55 scientific publications. Group B includes 8 publications equivalent to a habilitation thesis – six in Q1 and two in Q2, with the candidate being first author in one of them. A total of 190 points have been reported for this group, against a required minimum of 100. Group G includes 12 publications – seven in Q1, one in Q2, two in Q3, and two with SJR without IF; she is first author in four of them. A total of 245 points have been reported in this group, against the required 220.

All submitted scientific works are thematically related to the announced competition and were published after the acquisition of the educational and scientific degree “Doctor”. The candidate is actively involved in the implementation of research projects: she is the leader of one national project (funded by the Bulgarian National Science Fund) and of the Bulgarian team in two international projects under the European Bank for Reconstruction and Development, as well as a participant in nine projects, four of which are national and five international.

The scientific output of Assoc. Prof. Georgieva has had a significant impact in scientific literature. For the period 2013–2025, 546 citations in publications indexed in Scopus/WoS have been reported, of which 210 refer to scientific publications submitted as part of the habilitation thesis and 336 to publications outside the habilitation thesis. One doctoral student has successfully defended a dissertation under her supervision.

The presented data show that the candidate’s research and research-and-development activities not only meet but exceed the minimum national requirements for holding the academic position of “Professor” in professional field 4.2. Chemical Sciences, scientific specialty

“Electrochemistry”, in accordance with the Academic Staff Development Act, the regulations for its implementation, and the Regulations on the Terms and Procedure for Holding Academic Positions at the Institute of Physical Chemistry – BAS.

## **2. Main scientific and research-and-applied research contributions**

The scientific works submitted for the competition are characterized by thematic consistency and a clearly defined scientific focus on the development of advanced nanostructured electro- and photoelectrocatalytic materials for applications in fuel cells, electrolyzers, and photoelectrochemical systems. The research is in line with the thematic priorities of the Institute of Physical Chemistry – BAS and focuses on elucidating the relationships between the composition, structure, morphology, and electronic properties of catalytic materials and their electrocatalytic activity and stability.

A significant original contribution is the development and application of low-temperature and environmentally friendly approaches for the synthesis of nanostructured catalytic systems through the combination of chemical deposition, photochemical reduction, and galvanic replacement. These approaches enable the controlled formation of multicomponent metal and metal–oxide structures and more efficient use of noble metals, providing a methodological basis for targeted control of the composition and structure of electrocatalysts.

The scientific contributions of the works included in the competition can be divided into the following thematic areas:

- In the field of electrocatalytic methanol oxidation (MOR), a significant structure–activity relationship has been established in Pt-based catalytic systems. It has been shown that electrocatalytic activity is determined by the complex interaction between the active metal phase, the support, and the conductive carbon phase, as well as by the electronic interactions among them. A contribution of particular significance is the development of bimetallic Pt(Cu) and Pt(Ni) nanostructured electrocatalysts on carbon, oxide, and composite supports. It has been established that the incorporation of transition metals induces electronic and geometric changes in the Pt-based active phase, which substantially affect adsorption–desorption processes and catalytic activity during MOR.

A significant scientific result is the identification of the key role of metal–support interactions in Pt/TiO<sub>2</sub>, Pt/WO<sub>3</sub>, and composite systems. It has been demonstrated that the nature of the support affects the electronic properties, CO tolerance, and stability of the catalytic system. The role of interactions between metal nanoparticles and semiconductor oxide components has also been elucidated, including the involvement of photogenerated charge carriers in photoelectrocatalytic processes. These results are important both for the fundamental understanding of catalytic mechanisms and for the development of catalysts with reduced noble-metal content.

- In the area of electrocatalytic oxygen-involving reactions (ORR and OER), a consistent strategy has been developed for obtaining nanostructured electrocatalysts with reduced noble-metal

content. Through controlled formation of the active phase, use of bimetallic interactions, and optimization of metal–support interactions, Pt–Cu/C, Pt–Co/C, and IrO<sub>2</sub>/TiO<sub>2</sub> systems have been obtained, exhibiting maintained or improved catalytic characteristics at lower noble-metal content. A scientific novelty is the extension of synthesis methods to oxide supports and photochemical approaches, enabling the preparation of highly dispersed nanostructures. The functional role of TiO<sub>2</sub> and WO<sub>3</sub> in regulating the dispersion, electronic properties, stability, and catalytic activity of the active phase has been established.

- An especially significant contribution is the development of electro- and photoelectrocatalytic systems based on oxide semiconductors and metal–oxide composites. A synergistic mechanism between photo- and electrocatalytic processes in the oxidation of organic compounds on TiO<sub>2</sub>- and WO<sub>3</sub>-based systems has been established, and the role of photogenerated charge carriers in enhancing catalytic activity has been elucidated. Modified TiO<sub>2</sub> nanostructures have been developed through co-doping with boron and nitrogen, resulting in changes in the electronic structure, improved charge-carrier separation, and enhanced photoelectrochemical activity.

An original contribution is the proposal of a mechanism for obtaining Pt(Cu)/TiO<sub>2</sub> composite catalysts, in which the role of Ti(III)/Ti(IV) redox transitions in the formation and stabilization of the active metal phase has been demonstrated. It has been established that metal–oxide interactions are a determining factor for the electronic and structural characteristics of composite materials and, consequently, for achieving high catalytic activity and stability. On this basis, a concept has been developed for controlling electrocatalytic and photoelectrocatalytic properties by combining metal nanoparticles, semiconductor oxides, and controlled photochemical processes.

In summary, the presented results demonstrate a consistent and targeted development of the research – from the development of bimetallic Pt-based electrocatalysts to the creation of complex metal–oxide and photoelectrocatalytic systems. A significant achievement is the establishment of a methodological basis for controlling the composition, structure, and electronic properties of nanostructured catalysts, including through the controlled formation of core–shell structures and optimization of metal–metal and metal–support interactions. The results expand knowledge of the factors determining electro- and photoelectrocatalytic activity and stability and have a clear applied research potential for the development of high-efficiency catalysts for fuel cells, electrolyzers, and photoelectrochemical systems.

### **3. Impact of the candidate's scientific publications in Bulgarian and international literature**

The scientific publications of Assoc. Prof. Jenia Georgieva have received significant attention and recognition from the scientific community in Bulgaria and abroad. This is confirmed by the reported 546 citations in publications indexed in Scopus/WoS for the period 2013–2025, which is an indicator of the visibility and scientific impact of the results presented in the competition.

#### **4. Critical comments and recommendations concerning the candidate's scientific works**

Upon reviewing the submitted scientific works, I have not identified any significant omissions or weaknesses that would call into question the scientific value of the results obtained. I have no critical comments or specific recommendations concerning the candidate's scientific output.

#### **CONCLUSION**

On the basis of the submitted materials and the overall assessment of the research, research-and-development, and project activities of Assoc. Prof. Dr. Jenia Stefanova Georgieva, I consider that her candidacy is distinguished by high scientific productivity, thematic consistency, and significant scientific and research-and-development contributions in the field of electrochemistry and electrocatalysis. The candidate's scientometric indicators not only meet but exceed the requirements of the Regulations of the Institute of Physical Chemistry – BAS and the applicable national requirements for holding the academic position of "Professor".

The presented results demonstrate an independent and consistently developed line of research aimed at creating and optimizing nanostructured electro- and photoelectrocatalytic materials, as well as at elucidating the fundamental factors determining their activity and stability. In my opinion, the candidate's scientific contributions are significant, well substantiated, and have potential for practical application in modern energy and photoelectrochemical technologies.

On this basis, I give a positive assessment of the candidate and strongly recommend that the Scientific Jury at the Institute of Physical Chemistry – BAS award Assoc. Prof. Dr. Jenia Stefanova Georgieva the academic position of "Professor" in professional field 4.2. Chemical Sciences, scientific specialty "Electrochemistry", for the "Electrochemistry and Corrosion" Section at the Institute of Physical Chemistry – BAS.

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Prepared by:

(Prof. Dr. M. Petrova)