

STATEMENT

in the competition for the position of Professor in Field 4.2 (Chemical Sciences), specialization "Electrochemistry," for the needs of the "Electrochemistry and Corrosion" Section at the "Rostislav Kaishev" Institute of Physical Chemistry, Bulgarian Academy of Sciences (BAS) announced in the State Gazette, Issue 44 of 14 May 2026, with a single candidate: Zhenya Stefanova Georgieva, PhD, Associate Professor.

Member of the scientific jury: Anton Angelov Momchilov, PhD, Professor.

1. General characteristics of the candidate's research and applied research activities.

Assoc. Prof. Zhenya Georgieva has authored a total of 55 scientific publications based on her research. Her work aligns with one of the key thematic priorities of the Institute of Physical Chemistry (BAS): the development of advanced materials and technologies based on electrochemically produced metal, alloy, and modified polymer coatings with protective, decorative, and electrocatalytic properties. Methods have been developed for the preparation of nanostructured composite catalysts for the electro-oxidation of organic compounds, as well as for oxygen reduction and evolution reactions. Almost all studies have been conducted in international collaboration with leading research groups in the field. A total of 20 scientific works has been submitted for the competition; of these, 8 are habilitation-level works—6 in Q1 and 2 in Q2. In addition to these, 12 works published in foreign journals were submitted, distributed as follows: Q1 – 7, Q2 – 1, Q3 – 2, and 2 publications in refereed journals with an SJR but without an Impact Factor (IF). Her research activity is presented in accordance with the requirements of Art. 29, para. (1), item 5 of the Act on the Development of the Academic Staff in the Republic of Bulgaria (ADASRB) and the Regulations of the Institute of Physical Chemistry (IPC), as specified in Annex No. 1. Assoc. Prof. Georgieva fully meets these requirements, with scores for indicators B, C, D, and E exceeding the minimum thresholds. Indicator D is particularly noteworthy. I would also like to highlight her independent supervision of a PhD student who has successfully defended their thesis.

2. Key scientific and applied scientific contributions.

Low-temperature, environmentally friendly methods have been developed for the synthesis of platinum-based, nano-dispersed composite catalysts for methanol oxidation. These methods enable precise control over the composition, size, and dispersion of the active phase. This ensures both a reduction in precious metal content and more efficient use of the metal. Properties enhancing resistance to poisoning by CO-containing intermediates have been identified; this is a crucial factor for the long-term performance of platinum catalysts. Subsequent research (conducted after the habilitation) revealed the formation of a protective Pt-enriched shell over a Cu-containing core, which accounts for the high intrinsic catalytic activity in CO and methanol oxidation. The formation of a complex hierarchical structure has been observed in Pt(Ni)/C catalysts. Subsequent studies have demonstrated that the enhanced activity of Pt(Ni)/TiO₂ and Pt(Ni)/TiO₂–C catalysts is primarily determined by the synergistic interaction between the Pt nanoparticles and the TiO₂ support. The role of metal–oxide interactions in the formation of catalytically active sites has been elucidated, and an explanation for the observed

synergistic effects at the molecular level has been provided. Another area of focus involves ORR and OER catalysts with reduced noble metal content. It has been found that Pt–Cu/C exhibits up to 56% higher specific activity compared to a commercial Pt/C catalyst at a potential of 0.85 V vs. RHE, due to interactions between Cu and surface Pt atoms. The developed Pt–Co/C catalysts exhibit approximately 2.6 times higher mass activity and 4 times higher intrinsic catalytic activity compared to a commercial Pt/C catalyst at 0.85 V vs. RHE. For the OER, IrO₂/TiO₂ catalytic systems with high dispersion and activity were developed using a novel low-temperature photochemical method. The developed Pt–Co/C catalysts exhibit approximately 2.6 times higher mass activity and 4 times higher intrinsic catalytic activity compared to a commercial Pt/C catalyst at 0.85 V vs. RHE. For the OER, IrO₂/TiO₂ catalytic systems with high dispersion and activity were developed using a novel low-temperature photochemical method. Another area of focus is catalysts for photo-electrocatalytic processes. My primary interest lies in the quantitative assessment of the intrinsic photo-electrocatalytic activity of TiO₂ photoanodes using electrochemical impedance spectroscopy. In the photo-electrocatalytic oxidation of methanol, it has been established that the activity of Pt/TiO₂ catalysts depends on the interaction between Pt and TiO₂, as well as on the crystalline modification of the TiO₂. In post-habilitation research, a mechanism for producing Pt(Cu)/TiO₂ composite catalysts has been proposed for the first time. A concept for controlling their electrocatalytic and photo-electrocatalytic properties has been developed.

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

The scientific works have a total of 546 citations, 336 of which are independent of the habilitation thesis. One of the works has 120 citations. I should also highlight the two review articles and the Scopus h-index of 25.

4. Critical remarks and recommendations regarding the candidate's scientific works.

None.

CONCLUSION

Based on the scientific work performed, an effective strategy for producing nanostructured catalysts with reduced noble metal content has been developed, and a scientific foundation for creating high-performance electrocatalysts has been established. The research activities conducted and the fact that the requirements of the Act on the Development of Academic Staff in the Republic of Bulgaria (ADASRB) and the Regulations of the Institute of Physical Chemistry (IPC-BAS) have been exceeded provide me with full confidence to recommend that the esteemed Scientific Jury propose to the Scientific Council of the IPC the appointment of Assoc. Prof. Dr. Zhenya Stefanova Georgieva to the academic position of "Professor" in the professional field "4.2 Chemical Sciences," scientific specialty "Physical Chemistry," for the needs of the "Electrochemistry and Corrosion" Section at the "Acad. Rostislav Kaishev" Institute of Physical Chemistry of the Bulgarian Academy of Sciences (BAS).

Date: 27.09.2026

Prepared by: Prof. Dr. Anton Momchilov

