

STATEMENT

on the competition procedure for occupation of the academic position "Associate Professor" in the professional field 4.2 Chemical Sciences (Chemistry of Solid State) published in the State gazette No. 24/ 17.03. 2023

Member of the scientific jury: Prof. DSc Nikolay Nedyalkov Nedyalkov, Institute of electronics, Bulgarian Academy of Sciences

The only candidate for the mentioned competition is Dr. Lyuben Dimitrov Mihaylov, assistant professor in the Department of Applied Inorganic Chemistry at the Faculty of Chemistry and Pharmacy of Sofia University "St. K. Ohridski". In 2013, he successfully completed his doctoral studies there on the topic "Electrocatalytic activity of amorphous and nanocrystalline alloys for hydrogen evolution". Since 2013, he has been working at the Faculty of Chemistry and Pharmacy, holding the positions of chief specialist in chemical sciences in the period 2015-2021 and assistant professor from 2021. The main areas of his professional activity are related to scientific work in the field of preparation and characterization of nanostructured materials, conducting complex analyzes based on Transmission Electron Microscopy, Scanning Transmission Electron Microscopy, Energy Dispersive Spectroscopy. Leads lectures and exercises at the Faculty of Chemistry and Pharmacy at Sofia University "St. K. Ohridski".

The submitted documents for the competition and their content provide an opportunity for a clear evaluation and analysis of the scientific, applied and teaching activities of Dr. Mihaylov. 17 scientific publications were submitted for participation in the competition, of which 16 were published in journals with an impact factor, and 1 of the publications was in a publication with an impact rank. All presented publications are after obtaining the scientific and educational degree "doctor" and were published in the last 8 years, which is a clear indication of active work at the current stage of his career. As an example of the quality of the candidate's scientific work, the fact that the main part of the presented publications are in issues from quartile Q1 can be pointed out. 395 citations of works in which he is a co-author were submitted for participation in the competition. Self-citations are also given in the presented list. If they are excluded, the remaining number exceeds the necessary minimum. Dr. Mihaylov has participated or is participating in 10 projects under national and international programs as a member of a team. The Hirsch index according to SCOPUS is 12. Dr. Mihaylov's teaching activity is related to conducting lectures and practical exercises in bachelor's and master's programs in Applied Electrochemistry, Transmission Electron Microscopy, Processes and Apparatus, and Inorganic Chemical Technologies at the Faculty of Chemistry and Pharmacy. It consists of 990 hours of lectures and practical exercises and extracurricular classes of 77 hours for the period 2017 - 2023. He was the supervisor of 1 and a consultant of 2 diploma theses. Dr. Mihaylov has participated in 17 conferences, which proves his skills in presenting scientific results and leading discussions. With his scientometric data, the candidate exceeds the minimum requirements set by ADASRB and the criteria accepted by the Scientific Council of the Faculty of Chemistry and Pharmacy of Sofia University "St. Kliment Ohridski". Scientific publications are presented in journals that are referenced and indexed in world-renowned databases of

scientific information, which are equivalent to habilitation work (indicator B). The total number of points under this indicator is 110, with a minimum of 100. Under indicator D, publications are presented that are equivalent to 285 points out of the required 220. According to indicator D, related to citations of works in which Dr. Mihaylov is a co-author, the indicated points also exceed the required ones. According to indicator G, the equivalent points also significantly exceed the required ones (258, against the required 70).

The scientific activity of Dr. Lyuben Mihaylov is directed to the field of obtaining, characterizing and developing applications of nanostructured surfaces and nanostructures based on metal alloys, oxides and phosphates. The main approach used for production is electrochemical selective dissolution of components from the metal alloys $Zr_{67,5}Cu_{15}Ni_{10}Al_{7,5}$, $Zr_{55}Ni_{30}Al_{10}Pd_5$, $Zr_{65}Ni_{30}Pd_5$, $Pd_{30}Ni_{50}Si_{20}$, $Pd_{40}Ni_{40}Si_{20}$, $Cu_{60}Ag_{30}Al_{10}$. The description of the properties of the considered materials is complex, including analyzes of the composition, structure and morphology of the starting and obtained materials, as well as basic catalytic and electrochemical parameters of the obtained materials with a specific focus on applications in the field of catalysis and the development of electrodes for lithium - ion batteries. The research also includes detailed analyzes of the influence of various preparation parameters, selective dissolution and further processing on the characteristics of the resulting materials. In another group of works, oxides and phosphates are considered as new electrode materials for lithium/sodium-ion batteries, and various characteristics related to the dynamics in real use as electrodes are described. RhNi bimetallic catalysts for methane conversion have been developed and investigated, and changes in the material structure have been described based on TEM analyses. Another group of works presents a study of the dynamics of formation and size growth of gold nanoparticles obtained by the Turkevich method. The work on studies of the interaction of Pt nanocapsules with cancer cells is also of a contributing nature. The topics developed by Dr. Mihaylov are current and cause considerable interest from the point of view of practical applications in the field of increasing the efficiency of key chemical processes and energy sources, while also affecting a number of fundamental issues such as the mechanisms of electrochemical nanostructuring, the influence of experimental parameters on work processes, effective control of the parameters of the obtained structures. The chosen methods for obtaining both the starting materials and the nanostructured ones and the analysis methods are "classical", which makes them easy and cheap to apply and are the subject of research by a significant number of researchers and are applied in industry. This implies a significant interest in the developed problems.

The main scientific and scientific-applied contributions of Dr. Mihaylov's activity can be attributed to obtaining new knowledge and enriching existing knowledge in the field of electrochemical production of nanostructured materials with applications in the field of catalysis and the development of more efficient lithium-ion batteries; application of oxide and phosphates in such elements, obtaining and controlling dynamics of nanostructure formation, applications of nanostructures in medicine. The description of the mechanisms and dynamics of dealloying of metal alloys can be noted as a contribution to the acquisition of new knowledge. A new method for obtaining electrodes without binder and carbon for lithium-ion batteries has also been developed. They consist of a nanoporous metal structure obtained by electrochemical

dissolution of alloys, which serves as a mechanically stable and conductive base in which an active material is directly deposited. A key result is the demonstrated potential of sodium-deficient nickel-manganese oxides with a P3-type structure for application as low-cost electrode materials in both sodium and lithium-ion batteries. The demonstration of cytotoxicity of platinum ion-containing structures on cancer cells can be indicated as a result with potential development and significant social significance.

The results on the influence of various experimental parameters on the structure and morphology of nanostructured alloys obtained by selective electrochemical dissolution can be regarded as a significant enrichment of existing knowledge. The presented positive results in their use as catalysts and electrodes in batteries is also a significant contribution to demonstrating the potential capabilities of these materials. The modifications described in Turkevich's method for obtaining gold nanoparticles with different formation and growth dynamics and the developed method for studying the dynamics of formation of gold nanoparticles at the air/water phase boundary should also be mentioned as significant contributions.

The personal contribution of Dr. Mihaylov, as described in the presented documents, is beyond doubt. It is essential for obtaining and interpreting the main results of the presented works. My personal impression from conversations with the candidate also confirms this. He is the lead author on 4 of the publications. In the rest, there is a main participation in the characterization of the properties of the considered materials and in the discussions and analyzes of the obtained results.

I have no significant critical comments on the content, as well as on the technical presentation of the documents. Some data can be refined. For example, in the list of citations it is recommended to have numbering and not to include self-citations. Also, the list of conferences should include details about the conferences themselves.

Conclusion:

My familiarization with the results of the research and teaching activities of Assistant Professor Dr. Lyuben Mihaylov gives me reason to believe that he is an established scientist with a significant contribution in the field of electrochemical methods for materials structuring, their characterization and the design of applications in the field of catalysis and battery development, with skills and ability to define and direct high-level research. He has a teaching activity, which, in addition to being a necessity for his position, determines opportunities for attracting young scientists and forming research groups. Quantitative indicators of his scientific activity correspond to the criteria set by the ADASRB and the Scientific Council of the Faculty of Chemistry and Pharmacy of Sofia University "St. Kliment Ohridski", necessary for holding the academic position of "associate professor". My personal opinion is that Dr. Mihaylov is a responsible scientist with deep knowledge in the field in which he works, highly motivated, open to working together with other teams.

Based on the above, I express my convinced support for his candidacy and recommend the Scientific Jury to support and propose to the Scientific Council of the Faculty of Chemistry and

Pharmacy of Sofia University "St. Kliment Ohridski", Dr. Lyuben Mihaylov, to be elected to the academic position of "associate professor" in the professional field 4.2. Chemical Sciences.

26.06.2023

Prof.DSc Nikolay Nedyalkov