

OPINION

on the competition for the academic position of “Associate Professor”
in a Higher education branch 4. Natural sciences, mathematics and informatics,
Professional field 4.2. Chemical sciences (Solid state chemistry)
announced in „State Gazette”, issue 24/17.03.2023

by Prof. Dr. Penka Vasileva Tsanova

Faculty of Chemistry and Pharmacy, University of Sofia „St. Kl. Ohridski”
Internal member of the Scientific jury appointed with Order No RD 38-132/24.03.2023
issued by Rector of the University of Sofia „St. Kl. Ohridski“

In the competition for the academic position of „Associate Professor” in Solid state chemistry at Faculty of Chemistry and Pharmacy of University of Sofia „St. Kl. Ohridski“ **one candidate** has submitted application - **Chief Assistant Professor Lyuben Mihaylov, Ph.D** - and has allowed to participate.

Lyuben Mihaylov is a Bachelor in Science in Mineral Technologies (2006) from the Faculty of Mining Technology, University of Mining and Geology „St. Ivan Rilski” and a Master in Science in Material Science (2009) from the Faculty of Chemistry and Pharmacy – Sofia University “St. Kl. Ohridski” (FCP-SU). In 2013 he defended in FCP-SU his thesis entitled “Electrocatalytic activity of amorphous and nanocrystalline alloys for separation of hydrogen” for obtaining the educational and scientific degree “Doctor of Philosophy” in 4.2. Chemical sciences (Solid state chemistry).

Dr. Lyuben Mihaylov worked at the Department of Applied Inorganic Chemistry, FCP-SU as a Chief specialist (2015-2021) and since 2021 till now he is a Chief Assistant Professor. Since 2022, Dr. L. Mihaylov is a member of the management board of the Bulgarian Crystallographic Society.

The teaching activity of Dr. L. Mihaylov covers courses for BSc and MSc at the Department of Applied Inorganic Chemistry, FCP-SU: Applied Electrochemistry, Transmission Electron Microscopy, Unit Operations and Processes, and Inorganic Chemical Technologies (a total of 990 h of lectures and 77 h of practical exercises). He was the co-supervisor of 1 graduate student.

Chief Assist. Prof. Dr. Lyuben Mihaylov **has submitted all necessary materials** and **they satisfy** the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation, and the Internal Rules of Sofia University "St. Kl.

Ohridski", as well as the specific requirements of the FCP-SU. The scientific activity of Dr. Lyuben Mihaylov covers 25 publications; all of them are indexed in Scopus and the total impact factor of the journals in which the candidate's works have been published is 79.819 (as shown by Dr. Mihaylov). Dr. Lyuben Mihaylov participated in the competition with 17 publications and all scientific works presented do not repeat the ones that have been previously used in the PhD degree. In terms of quantitative indicators, **the candidate exceeds the minimum specific requirements** of the FCP-SU for the academic position "Associate Professor":

- Group of indicators **B** – 5 scientific publications are presented, in journals that are referenced and indexed in world scientific information databases (4-Q1, 1-SJR): a total of 110 scores have been collected at a minimum of 100 scores;

- Group of indicators **Г** – 12 scientific publications (9-Q1, 3-Q2): a total of 285 scores have been collected at a minimum of 220 scores.

- Group of indicators **Д** – in total 395 citations* are presented resulting in 790 scores at a minimum of 70 scores according to the specific requirements of FCP-SU.

**Self-citations of all authors are not excluded; a total of 333 citations (Scopus, at June 4, 2023, self-citations of all authors are excluded) have been noted on Mihaylov's works resulting in 666 scores. The reduction of 124 points for Group of indicators B does not change the fact that the points for this group meet the requirements.*

- Group of indicators **Ж** – h-index 12, supervisor** of 1 graduate student (master's degree), 13 articles other than those in group **Д*****, participation in 10 research projects: collected 258 scores at a minimum of 70 according to the specific recommended criteria of FCP-SU.

***Dr. Mihaylov Co-supervisor of graduate student: - 5 scores;*

****They are not found in the presented materials: -78 scores.*

The reduction of 83 points for Group of indicators Ж does not change the fact that the points for this group meet the requirements.

For the application in the present competition Dr. L. Mihaylov has presented a Habilitation thesis entitled "Preparation and study of porous metal structures as catalysts and electrodes in lithium-ion batteries" based on five thematically unified publications of his scientific research. In 4 of them he has a leading role as a first author and in one he is a second author. The subject of the Habilitation thesis is the synthesis and complex structural and physicochemical characterization of new porous metals with applications in catalysis and energy storage. The candidate's habilitation thesis is structured in two parts: the introductory part formulates the purpose of the studies conducted by the author on the base of the scientific achievements in the field. In the part devoted to scientific results and contributions, the

candidate has presented the achievements on i) the synthesis and characterization of the starting alloys: $Zr_{67,5}Cu_{15}Ni_{10}Al_{7,5}$; $Zr_{55}Ni_{30}Al_{10}Pd_5$; $Zr_{65}Ni_{30}Pd_5$; $Pd_{30}Ni_{50}Si_{20}$; $Pd_{40}Ni_{40}Si_{20}$; $Cu_{60}Ag_{30}Al_{10}$, ii) the preparation of porous metal structures by selective chemical/electrochemical dissolution of the resulting alloys, iii) structural and morphological characterization of the porous materials and iv) applications of the porous structures: $Cu_{60}Ag_{30}Al_{10}$ as electrodes in lithium-ion batteries and electrocatalytic activity of $Pd_{30}Ni_{50}Si_{20}$ and $Pd_{40}Ni_{40}Si_{20}$.

The presented habilitation thesis and the author's reference for the scientific contributions of the works gives a clear idea of the research carried out and the contribution of the Dr. Lyuben Mihaylov in their implementation. The scientific research of Dr. Mihaylov is focused on the field of chemistry/physical chemistry of the solid state and inorganic chemistry, and defines **two main directions of research interest**:

1. Synthesis and characterization of metal alloys, and their selective chemical/electrochemical dissolution in order to obtain porous materials with application in electrocatalysis and ionic batteries.

2. Characterization by TEM and STEM/EDS of the morphology and structure of inorganic (nano)materials. Mainly, the works related to electron microscopic studies can be divided according to the type of analyzed materials and their practical purpose:

✓ Oxides and phosphates (a precise description of the different materials in the specific scientific papers is presented in the competition materials) as innovative electrode materials for lithium/sodium-ion batteries;

✓ Supported mono- and bimetallic RhNi nanoparticles as catalysts for dry reforming of methane;

✓ Gold nanoparticles obtained by different methods;

✓ Pt(II) nanocapsules and their uptake by two types of cancer cells.

The main contributions of Mihaylov's research can be briefly summarized as follows:

- A proven contribution of Dr. L. Mihailov is his active participation in the synthesis of metal alloys and their characterization with TEM, STEM-EDX and SEM, in electrochemical testing, as well as in the interpretation of research results and the writing of publications.

- Since Dr. Lyuben Mihaylov has considerable experience in sample preparation and analyses with TEM, STEM-EDX, electron diffraction (SAED) of various materials, I assume that his significant contribution to the research is the characterization of the morphology, microstructure and phase composition of the studied materials through professional

interpretation of data from TEM/HRTEM micrographs, EDX spectra and SAED images. This provides elucidation of the shape, average size and particle size distribution of the respective material and allows to make conclusions on the structural stability of the newly synthesized materials as i) catalysts or ii) electrodes for ion batteries in the course of the electrochemical reaction, as well as to make conclusions about the electrochemical inertness of certain phases or local regions in the materials.


- Last but not least is the candidate's contribution in discussing the microstructural information from TEM/HRTEM and SAED studies of gold nanoparticles synthesized by chemical reduction using different methods and the final interpretation of the influence of different factors (presence of Cu^{2+} ions, presence of chitosan, a monolayer of hexadecylaniline at the water/air interface) on the synthesis kinetics. The analysis of STEM images and EDS spectra has made important contributions to studies concerning the uptake of platinum by two types of cancer cells treated with Pt(II) nanocapsules.

The main results of the scientific research of Dr. Lyuben Mihaylov were also promoted through poster presentations at a total of 17 scientific conferences, 10 - after the defense of PhD thesis.

Assistant Professor Dr. Lyuben Mihaylov participated in the research teams of a total of 10 international projects, 6 - after the defense of PhD thesis.

In conclusion, taking into account the analysis of the scientific research carried out by the candidate and the presence of undeniable contributions, as well as my personal impressions of the candidate's qualities, I express my **positive opinion** Dr. Lyuben Mihaylov to be elected as Associate Professor of 4.2. Chemical sciences (Solid state chemistry) at the Faculty of Chemistry and Pharmacy, University of Sofia "St. Kliment Ohridski".

28.06.2023 г.
Sofia

Chair of the Scientific Jury: 
(Prof. Dr. P. Vasileva)