ATTITUDE OF REVIEWER

on a competition for occupation of the academic position “Associate Professor” in the professional field 4.2. Chemical Science (Solid State Chemistry) for the needs of the Department of Applied Inorganic Chemistry, Faculty of Chemistry and Pharmacy, Sofia University, announced in State Gasette, issue 24/17.03.2023

by Assoc. Prof. Boriana Venelinova Donkova, PhD,
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In the announced competition for Associate Professor in the professional field 4.2. Chemical Sciences (Solid State Chemistry) the only candidate is Assistant Professor Luben Dimitrov Mihaylov, PhD, member of the Department of Applied Inorganic Chemistry, Faculty of Chemistry and Pharmacy (FCP) at Sofia University (SU). The documents submitted by the applicant are in accordance with the Rules for the implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the specific requirements for occupation of academic positions at the Faculty of Chemistry and Pharmacy, Sofia University.

The candidate's educational and scientific profile is fully in line with the objectives of the competition and scientific fields, developed and maintained in the Department of Applied Inorganic Chemistry (AIC). Luben Mihaylov graduated from Mining Technology Faculty of the Mining Geological University "St. Ivan Rilski" in 2006 as a bachelor. In 2009 he is graduated from Faculty of Chemistry and Pharmacy, Sofia University as a Master of Chemistry, specialization Material Science. In the period from 2010 to 2013 he was a full-time PhD student at the Department of Applied Inorganic Chemistry, FCP-SU. The candidate defended his PhD thesis on the topic "Electrocatalytic activity of amorphous and nanocrystalline alloys for hydrogen evolution" (Group of indicators A - 50 points from 50). In 2013 he was appointed as a Senior Specialist in Chemical Sciences in the Department, his main activity being in the Transmission and Scanning Electron Spectroscopy Laboratory. Since 2021 he has been assigned as a Senior Assistant Professor in the department AIC.

The candidate Dr. Lyuben Mihaylov is the author and co-author of 25 publications, visible in the information databases Scopus and Web of Science. The latest scientometric reports

(June 2023) shows 342 citations (excluding self-citation) in the first database and 384 -in the second; the achieved Hirsch index (h) is 12. The results were presented at 17 scientific forums in the period from 2011 to 2023. However, due to the insufficient bibliographic information generating from the „Authors" system it is not clear the type of the forums.

To participate in the competition, Dr. Luben Mihaylov submitted 17 research articles, published in the period 2015 - 2022 in refereed and/or indexed journals with scientometric indicators. According to the journals' quartile they are categorized as follows: Q1 - 13, Q2 - 3; the last one is in the Proceedings of SPIE with SJR. As of June 2023, noted independent quotations on these 17 articles were 263 (Scopus), with 9 of them cited more than 9 times.

The candidate has submitted a habilitation thesis based on five publications (group indicators B). Four of them are in journals with the highest quartile (Q1) and the fifth is in a refereed journal with SJR (110 pts./100). These papers reflect the main research interests and achievements of the candidate and are in the field of solid state chemistry, electrochemistry and materials science. Dr. Mihaylov's efforts have been concentrated in synthesis of amorphous and crystalline alloys, preparation of porous materials by selective chemical and electrochemical dissolution, morphological and microstructural characterization, testing the applicability of porous structures in lithium-ion (Li-ion) batteries and electrocatalysis. The main scientific contributions of the candidate (evident from the fact that in four of the articles he is the first author and in the fifth - the second) can be summarized as follows:

- establishing the influence of various factors (temperature, electrolyte, electrochemical potential, alloy composition - $Zr_{67,5}Cu_{15}Ni_{10}A_{l7,5}$, $Zr_{55}Ni_{30}Al_{10}Pd_5$, $Zr_{65}Ni_{30}Pd_5$, $Pd_{30}Ni_{50}Si_{20}$, $Pd_{40}Ni_{40}Si_{20}$ и $Cu_{60}Ag_{30}Al_{10}$, selective dissolution method) on the morphology and microstructure of the porous material;

- establishing a correlation between the composition and structure of the porous material and its catalytic activity, or its applicability as an electrode (after deposition of active compounds) in Li-ion batteries

- preparation of a promising porous material from $Cu_{60}Ag_{30}Al_{10}$ alloy, suitable 1) for $LiMnPO_4$ deposition, or 2) for S deposition, thus allow for the first time to be fabricated $LiMnPO_4$-based electrodes or hierarchically porous 3D Ag_2S - Cu_xS electrodes without binding and carbon additives. Both types of electrodes have high productivity as well as cycling stability. (Both studies are published in Dalton Transactions; IF=4.57)

To the group of indicators Г, Dr. Mihaylov has included 12 publications. Nine of them are in journals with quartile Q1, three - in journals with quartile Q2 (285 pts./220). The submitted “Author’s report on the contributions of the scientific papers” is focused on the candidate's contributions to the main objectives of the conducted research, which contributions are also related to his high professional competence and qualification in the field of electron microscopy and diffraction analysis methods. The candidate's contribution can be summarized in the following groups:

i) characterization of the morphology and structure of various objects, thereby *confirming* and *complementing* the results of experiments carried out (4 papers, Nos. 14-17);

ii) investigation of the morphology and structure of oxides and phosphates as innovative electrode materials for Li-ion batteries, thereby *explaining* the results obtained (8 papers, Nos. 2, 7-13). Through appropriate sample preparation, conducting TEM, STEM-EDX, SAED analyses and thorough interpretation of the results, it was demonstrated for the first time: i) the influence of particle size of P3-$Na_xNi_{0,5}Mn_{0,5}O_2$ on the reversible Na^+ intercalation and the superstructure’s ordering after the electrochemical reaction; (ii) the participation of the olivine phase $NaMnPO_4$ in the reversible intercalation of Li^+ and Na^+; (iii) the influence of the composition and structure on the performance of new cheaper $Na_xCo_{1/3}Ni_{1/3}Mn_{1/3}O_2$-based cathode materials; iv) the formation of two co-existing intercalation phases of Li and Na and their influence on the performance of a new type of hybrid sodium-lithium-ion cell with a unique electrode combination; v) intercalation of Li^+ and Mg^{2+} ions on deposited Mn_5O_8 in non-aqueous electrolytes and influence of the formed post-cyclization spinel structure on the retention of capacity upon continuous cycling.

To the group of indicators Д, the candidate has attached a list of 395 citations (790 pts./70). 48 of these citations are self-citations of the authors, therefore I have decreased the points to 694. Despite this correction, the candidate's score is far above the 70 points required by the enhanced criteria of FHF-SU.

In group of indicators Ж, the required minimum is 70 pts.. The high Hirsch index (h=12) assures 120 pts. and by supervising a defending graduate student, articles outside group Г and participation in projects, the candidate achieves 258 pts.

Dr. Mihaylov's teaching activity includes several lecture courses for students at Bachelor and Master degree level, developed in the period 2017-2023: "Applied Electrochemistry", "Transmission Electron Microscopy", "Processes and Devices", "Inorganic Chemical

Technologies”. He works successfully and fruitfully with undergraduate, graduate and PhD students, as evidenced by the numerous articles (9) with their participation.

In conclusion, the candidate’s achievements exceed both the minimal national requirements for scientific and teaching activity in the field of higher education 4.2. Chemical sciences and the requirements for occupation of the academic positions "Associate Professor" at the Faculty. On the basis of the foregoing, I give my positive evaluation and I recommend Ass. Prof. Dr. Luben Dimitrov Mihaylov to be appointed as "Associate Professor" in the Department of Applied Inorganic Chemistry at the Faculty of Chemistry and Pharmacy, Sofia University “St. Kliment Ohridski”.

25.06.2023

Signature:

/ Assoc. Prof. Borjana Donkova/