

## **PEER REVIEW**

Submitted by Prof. Dr. Alexander Eliyas Eliyas –Institute of Catalysis - BAS in connection with the competition for occupying of the academic position Associated Professor in the professional field 4.2 “Chemical Sciences”, scientific specialty “Chemical Kinetics and Catalysis” for the needs of the Institute of Catalysis - BAS

### **Description of the administrative procedure**

I was appointed as member of the Scientific Jury by an Order № RD-09-53 dated 21.09.2020 issued by the Director of the Institute of Catalysis - BAS (IC-BAS), in the competition examination for occupying the the academic position Associated Professor in the professional field 4.2 “Chemical Sciences”, scientific specialty “Chemical Kinetics and Catalysis”, announced for the needs of the Laboratory „New Heterogeneous Catalysts for Clean Energy Production and Protection of the Environment“ in IC - BAS published in Newspaper of State No.67 dated 28.07.2020 following a decision of the Scientific Council of the Institute of Catalysis - BAS (Record of Proceedings № 8/18.09.2020). There was a meeting of the Jury Members on 9.10.2020 and I was appointed to prepare a Peer Review Opinion. I have at my disposal the “Regulations for the conditions and the order for occupying academic positions in IC-BAS” and I was given a compact disc, containing respectively all the required documents: a copy of the announcement in Newspaper of State, curriculum vitae of the candidate, diploma for acquiring PhD scientific degree, abstract of the PhD thesis, certificate for length of the service in the specialty and period of occupying the academic position „Senior Assistant“, record of correspondence with minimum of requirements of BAS and those of IC, complete list of all research publications and a separate list of publications, submitted for participation in the competition and the PDF files of the articles, abstracts of the research publications submitted for participation in the competition in Bulgarian, author’s description of the research contributions – those of the habilitation works and those not included in the habilitation works, list of participations in scientific events, projects and expert activities.

### **1. General presentation of the obtained materials**

The only candidate participating in the competition for occupying of the academic position „Associated Professor“, published in Newspaper of State No.67 dated 28.07.2020 and on Internet – web page of the Institute of Catalysis - BAS, is the Senior Assistant PhD

Radostina Dimitrova Palcheva. The complete set of materials, submitted by her is in complete correspondence with Article 29 of the Law for the Development of the Academic Staff in the Republic of Bulgaria LDASRB, Articles 31 and 32(1) of the Regulations for the conditions and order of acquiring scientific degrees and occupation of academic positions in BAS and Articles 47(1) and 48(1) of the Regulations for the conditions and order of acquiring scientific degrees and occupation of academic positions in the Institute of Catalysis. Her Diploma №31032 for the educational and research degree „PhD” dated 29.01.2007 bears the code 01.05.16 „Chemical Kinetics and Catalysis” i.e. it coincides with the specialty for which the competition was announced. The topic of her PhD thesis is „Synergism between the components in NiW/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalysts for hydrodesulphurization” – purification of oil fractions and fuels from sulfur-containing organic compounds is a topic of great actuality for the Institute of Catalysis - BAS.

The candidate has a total number of 25 publications, out of which 21 publications are in journals having impact factor. The candidate has submitted 20 publications for participation in the competition – out of them 17 are in journals having impact factor. As one can see in represented materials 8 of the publications belong to category Q1, 4 others are quartile Q2, 3 are Q3 and 2 Q4. The verification reference shows that all the minimal requirements of BAS and those of IC are fulfilled – in Group B of Indices 3 or 4 the candidate has 130 points exceeding the minimal requirement of 100 points. It should be noted that in 10 of the articles she is the first author. The verification reference also shows that in Group C the sum of the indices ranging from 5 to 10 requiring a minimum of 220 points – the candidate has 229 points i.e. in this case she also exceeds the requirements.

The total number of noticed citations is 331 citations, whereupon all the self-citations of her co-authors are excluded. Among them the number of citations, noticed in ISI databases (Scopus and Web of Science) for the publications, participating in the competition is 297 - in Group D Index 11 for minimal requirement 60 she has  $297 \times 2 = 594$  points.

## **2. Short biography data of the candidate**

Chief Assistant Radostina Palcheva has graduated from the Sofia University „St. Kliment Ohridsky” – Chemical Faculty in the year 1999 acquiring Master of Science degree, in specialty Chemistry. Her Diploma thesis was on the topic „Influence of lanthanoid contraction for the sieve effect clinoptilolites“. The experience that she acquired in the course of this research work enabled her to develop further successfully her knowledge in the field of the zeolite catalysts and their application for hydrodesulfurization of oil fractions for

producing fuels at the Institute of catalysis – BAS, which she joined in the year 2001. During the period 2003-2006 she elaborated her dissertation work on the topic „Synergism between the components of NiW/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalysts for hydrodesulfurization”, which she defended successfully in 2007 acquiring PhD degree in accordance with the specialty and the notation of the announced competition.

After the successful defense she was appointed to occupy the position of Assistant, and from the submitted certificate it can be seen that on 21.09.2020 the candidate has a total of 14 years and 6 months length of service at the institute, from which 2 years in the position of chemist (2001 -2002 r), 11 years as Research Fellow II degree and Senior Assistant at IC-BAS. She has excellent knowledge of English language – both written and spoken.

### **3. Estimation of the basic research and applied research activities of the candidate**

- *Scientific research papers:*

Considering the total number of 25 research publications of Chief Ass. Palcheva, out of which she represented 20 for participation in the competition, it is seen that the publications are evaluated by SJR (Scimago Journal Ranking) and they are visible in Scopus (13) and in ISI Web of Knowledge (12). I would distinguish among them as most significant the publications in prestigious and well-reputed journals - Microporous and Mesoporous Materials (Q1), Journal of Materials Science (Q1), the two publications in Applied Catalysis – A:General & B:Environmental, also the two publications in Applied Surface Science (Q1), Topics in Catalysis (Q1) and Catalysis Letters (Q2). Of course we should also appreciate her contributions for the Bulgarian journals, which need our support – Bulgarian Chemical Communications – this circumstance does not deserve to be positioned in the last place, in spite of its lower quartile (Q4). Some of the publications come as a result of the useful cooperation with the Czech Academy of Sciences enabling access to apparatus, which is not available at IC BAS.

There are no claims by coauthors of the publications in regard to the participation of the candidate in the competition. There is no other information available about some form of incorrectness or elements of plagiarism with respect to the materials, submitted for participation in the competition, which was confirmed upon checking some of her main publications.

*Response in the scientific literature*

The total number of noticed citations of the publications, represented for participation in the competition by Chief Ass. Palcheva, is 297 at the date of submitting the documents and

they are in Scopus and Web of Science all of them, giving a total number of 594 points, exceeding considerably the required minimum. The total number of citations in international journals amounts to 331 citations. I would like also to point out the fact that the Hirsh index (H) of the candidate, based on all the publications, included in the ISI database is very high – H = 13, which fact is very impressive.

*Participation in national and international scientific events:*

The candidate has listed in her curriculum vitae a total of 30 participations in scientific events, out of which 3 oral presentations and 27 poster presentations.

*Leadership and involvement in research projects, specializations*

Chief Ass. Palcheva was and at present she still is leader of 3 projects in line with the Equivalent Non-currency Exchange with Institute of Chemical Process Fundamentals – Czech Academy of Sciences – Prague for the periods 2008-2010, 2017-2020 r and the newest project 2020-2022. Moreover she was participant in 6 other research projects. In addition I would also point out her two-year long Postdoctoral specialization at the University of Oslo, where she acquired valuable experience and knowledge about the design of oxide materials for selective catalysis during the period 2010 -2012. She acquired considerable knowledge during her two-month specialization in Belgium in the laboratory of the world-famous scientists E. Gaigneux in the field of physico-chemical characterization of catalysts for clean energy production, and not in the last place several visits to the Institute of Chemical Process Fundamentals – Czech Academy of Sciences – Prague.

#### **4. Basic research and applied research contributions**

- *Scientific contributions*

The main part in the contributions of the candidate are connected with the elaboration, characterization and testing of composite catalyst samples based on cobalt, nickel, molybdenum and tungsten, deposited on alumina. They are of great importance for catalysis in view of pressing necessity for purification of oil fractions for production of fuels and mostly diesel fuel from the sulfur- and nitrogen- containing aromatic organic compounds, contained in the oil fractions by catalytic hydrogenation processes of hydrodesulfurization and hydrodenitrogenation. During the last years some new and more severe regulations have been introduced in regard to reducing the harmful emissions. On the other side the combustion of these S- N- containing compounds in the internal combustion engines leads to formation of sulfur and nitrogen oxides,

which upon their interaction with the water vapors form acidic gas mixture causing corrosive damage of the internal combustion engines.

What makes impression is the large number of analytical methods, which the candidate has mastered and applied in practice: determination of the microporous structure, X-ray diffraction, X-ray photoelectron spectroscopy, thermal gravimetric analysis, but most of all the experience gained in the methods of synthesis and testing the catalytic activity of the synthesized samples – all these methods, considered as a combination, show that the candidate is well trained and developed as specialist.

She paid special attention to discussing the factors, which determine the catalytic activity – these involve the different synthesis methods, as well as the various temperatures of thermal treatment, leading to differences in their chemical composition. Moreover the active components have been deposited on various supports and there is influence of modifying additives or complex-forming agents. All this variety of factors determined the wide range of these studies involving a multitude of characterization methods give us an idea of the complicated picture, appearing as a result of the research work.

I would like to point out the research contribution of proving the Keggin type of structure of the hetero-poly acids, deriving the respective general formula, as well as the flat molecular structure of Anderson type in the case of hexamolybdates, which have been used as precursors for the synthesis of W or Mo catalyst samples. These structures in combination with preliminary modification of the support alumina by nickel or cobalt from aqueous solutions of nitrates and the following impregnation resulted in samples possessing high catalytic activity, are proving the high level of scientific research. The studies have been continued further by expanding the research scope searching for other alternatives, including other additives – for example TiO<sub>2</sub> nanotubes and addition of oxides having basic character in order to improve the interaction between the active components and the support and the bond strength between them. It was useful to study the ratio Zn/Al and the quantity of the additive of SiO<sub>2</sub> to the mixed Al-Zn oxides, which improved the catalytic activity of Ni-Mo catalyst samples, studied in the reaction of hydrodesulfurization of thiophene.

Taking into account the second verification reference, submitted by the candidate – about the scientific contributions of the publications not included in the habilitation thesis one can see that the basic attention was focused on three main directions –

beside the Ni(Co)-Mo(W) catalysts for hydrodesulfurization of thiophene as a model compound she studied also HDS of 1-benzothiophene, which is much more difficult to decompose and it requires considerable improvement of the catalytic reactor and the method of testing of the catalytic activity of the samples. The second direction – these are the mono-metallic (Ni or Rh) and bi-metallic (Ni-Rh) catalysts, supported on mixed oxide and perovskites in reactions of partial oxidation of methane and reforming of methane with CO<sub>2</sub>. The third direction comprises the catalysts for complete oxidation of ethanol, dehydration of glycerol and conversion of ethylene into propylene. The systematic renewal of the thematic scope is obvious and shifting of the attention to new modern directions having application aspect.

The fact that the studies of the candidate have led to testing of the catalyst samples not only under laboratory conditions, but also under industrial conditions in pilot plant makes strong impression. This was achieved in the Litvinov refinery in Prague in the HDS installation for light weight fuel fractions, whereupon the obtained results have been compared with two industrial Co-Mo catalysts for HDS process. This fact proves convincingly the applied research value of the studies of Chief Ass. Palcheva.

*Expert activities:*

The expert activities of Chief Ass. Palcheva comprise her reviewer's opinions on articles in prestigious international journals and probably in participation in organizing committees of different scientific events. She is member of the Bulgarian Catalysis Society giving her assistance in the organization of the National Conferences on Catalysis. It is a pity that such information is missing in the materials, submitted by the candidate – this omission is my only remark to the materials. These data are not obligatory in view of the Regulations – this aspect is left to the choice of the candidate.

The professional skills and expertise of Chief Assistant Palcheva, her qualities and capabilities working in a team have been confirmed by my contacts and those of my colleagues at IC - BAH. I have never participated in research project partnership together with Chief Assistant Palcheva. My only personal impression is based on the Contract "Operating Program for Development of human Resources" carried out by IC-BAS together with IGIC-BAS and the Chemical Faculty of Sofia University – I obtained some information about the level of her scientific research work.

I have no publications in co-authorship with the candidate and my opinion on her qualifications and scientific contributions is based almost entirely on the materials and

documents, which she submitted for participation in the competition and which were given to me on a CD.

### **5. Evaluation of the personal contribution of the candidate**

All the scientific research publications of Chief Assistant Palcheva, represented in connection with her participation in the competition for occupying the academic position „Associated Professor” in IC – BAS, are the result of joined team work, together with her colleagues from IC – BAS, as well as involving participation of foreign partners – mainly from the Czech Academy of Sciences. It is difficult for me to distinguish her personal contribution as experimenter or in the processing of the experimental data and in the interpretation of the experimental results – most probably she has considerable contribution in all three aspects.

### **CONCLUSION**

The documents and the materials, submitted by Chief Assistant Palcheva are in complete correspondence with all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the application of LDASRB of the Ministry of Education and the respective Regulations of BAS, as well as the specific requirements of the Institute of Catalysis - BAS. The candidate has represented sufficient number of research works, published after the materials, submitted for defending her PhD degree and for acquiring the academic position of Chief Assistant. There are original scientific research contributions in the submitted publications, whereupon the basic part of these are published in journals having impact factor, issued by well known international academic publishers. All these facts are giving me justification to give my positive estimate and to recommend convincingly to the members of the Scientific Jury to vote positively „YES” and to prepare report-proposal to the Scientific Council of IC-BAS for appointment of Chief Assistant Radostina Palcheva to occupy the academic position of „Associated Professor” in IC-BAS in professional direction 4.2 „Chemical Sciences”, scientific research specialty „Chemical Kinetics and Catalysis”.

10.11.2020

**Reviewer:**.....

(Prof. PhD Alexander Eliyas)