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## STANDPOINT

by Assoc. Prof. PhD Stanislava Metodieva Andonova  
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on the competition for occupying the academic position an Associate Professor in a professional field 4.2. "Chemical Sciences", scientific research specialty "Chemical kinetics and catalysis" for the needs of the Laboratory "New Heterogeneous Catalysts for Clean Energy Production and Environmental Protection" at the Institute of Catalysis (IC)- BAS, announced in Bulgarian State Gazette No. 67 of 28.07.2020

Assist. Prof. Dr. Radostina Dimitrova Palcheva is the only candidate in the announced competition. All the documents, required and specified by "The Regulations for the Terms and Rules for Occupation of Academic Positions in IC-BAS" have been duly submitted

Dr. Palcheva has received her Master's degree in 1999 at the Sofia University "St. Kliment Ohridski", Faculty of Chemistry. From 2001 to 2002 she worked as a chemist at the Institute of Catalysis - BAS. In the period 2003-2006 she was a PhD student at the IC-BAS where in 2006 she obtained the educational and scientific degree "Doctor" in the scientific specialty "Chemical Kinetics and Catalysis". In 2007 Dr. Palcheva won a competition as a Ch. Assist. Prof. at the same institute and since then she works in this position. The scholarships and post-doctoral positions won by the applicant for conducting specializations at leading research centers abroad have a significant contribution to her scientific development. In the period 2010-2012 she specialized in the field of "Design of oxide materials for selective catalysis" as a postdoctoral fellow at the University of Oslo, Norway. In 2014, the candidate won a two-month research fellowship on "Physico-chemical characteristics of catalysts for energy production" at the Catholic University of Leuven, Belgium.

The scientific research activity of the applicant comprises 25 scientific works, of which: 21 publications in *Peer-reviewed* (refereed or scholarly) journals with impact factor and four papers without impact factor. In the present competition, Dr. Palcheva participates with 20 scientific papers, published in reputable international journals between 2008 - 2020. Eight of these articles are in journals indexed with the highest category Q1 (2 of them heading the top rank list), 4 with Q2, 3 with Q3, 2 with Q4 and one more publication with a SJR, all included in the Web of Science database. Additionally, the candidate participates with two non-indexed publications from conferences. In the section "Habilitation work - scientific publications in journals that are referenced and indexed in world-famous scientific information databases (WoS or Scopus)" are presented 6 publications, covering B-4 indicator, with totally 130 points of the required 100 points. To the "Scientific publications in journals that are referenced and indexed in Web of Science and Scopus, outside the

habilitation work" are presented 14 articles covering the G-7 indicator, with a total of 229 points. Dr. Palcheva as co-author in her publications has 344 citations (Scopus), while the citations of the publications included to the competition are over 292. The H-index of the applicant according to the Scopus database is 12 (excluding self-citations of all authors) which exceeds the requirements. The leading personal contribution of the candidate in the research activity and interpretation of the scientific results is confirmed by the fact that Dr. Palcheva is the first author in 10, and the second in 4 of the presented publications.

The overall research activity included in the Habilitation of the applicant is focused on the development and characterization of new more efficient catalysts for production of environmentally friendly fuels with low sulfur content and thus respectively for environmental protection and reduction of harmful  $\text{SO}_x$  emissions. The topics of the publications are mainly related to the discussion of the various factors that determine the catalytic activity of the Co(Ni)-Mo (W) catalysts in the hydrodesulfurization (HDS) reactions of thiophene and 1-benzothiophene. Thus, it was found that the catalytic activity of hydrodesulfurization strongly depends on the method of preparation of the catalysts and the supports, as well as on their chemical composition, the heat treatment, the nature of the supports, as well as the influence of modifying additives and the complexing agents. The main scientific achievements can be summarized as follows:

- In the studies conducted by the applicant, it has been shown that the method of modification of alumina with nickel or cobalt from the aqueous solutions of their nitrate salts, the calcination and the subsequent impregnation of the support with Co(Ni)-Mo<sub>6</sub> leads to synthesis of highly active HDS catalysts. The most active catalyst in the 1-benzothiophene conversion reaction was prepared by sequential impregnation of nickel and molybdenum nitrate on mechanochemically produced alumina. This type of catalyst was found to be 1.4 times more active than the industrial NiMo/Al<sub>2</sub>O<sub>3</sub> (Albemarle, KF 846, The Netherlands).
- In several other studies, it has been found that the use of organic chelating complexes such as nitrilotriacetic or thioglycolic acids in the synthesis of the HDS catalysts is an effective method for obtaining more Co(Ni)-Mo-S active centers after sulfidation.
- Nb modified SBA-15 and HMS mesoporous materials were synthesized hydrothermally and they were used for the first time as supports of NiMo catalysts for conversion of thiophene and 1-benzothiophene. The mesoporous structure of the Nb-SBA-15 was found to be the reason for maintaining the dispersion of the NiMo phase after sulfidation. The sample synthesized by simultaneous impregnation of ammonium heptamolybdate, nickel nitrate and thioglycolic acid on Nb-SBA-15 showed higher activity compared to industrial KF 846 catalyst.
- The use of TiO<sub>2</sub> nanotubes (Ti-NT) as a support (prepared by hydrothermal synthesis method) significantly increases the catalytic activity of the NiW catalyst, measured in the reaction of HDS of thiophene, compared to NiW/Al<sub>2</sub>O<sub>3</sub> and NiW/TiO<sub>2</sub> samples.
- It has been used as an interesting alternative for the synthesis of heterogeneous catalysts by adding metal oxides, in order to improve the interaction between the active phases and the support. Thus, as a result of the additional modification of Al-Zn oxides with silica, it was found that the NiMo/Zn-Al<sub>0.16</sub>-Si sample exhibits a high activity in the temperature range 280–400 °C.

The review of the presented materials included in the Habilitation work shows that the research activity of the candidate is entirely in the field of the synthesis and characterization of HDS catalysts, as well as studies relevant to the understanding of the mechanisms of the catalytic reactions that occurs on the surface of the Co(Ni)-Mo(W) supported catalysts.

The other publications presented by Dr. Palcheva outside of the Habilitation work are divided into three main groups according to the type of catalysts used in different catalytic processes: (i) Ni(Co)-Mo(W) hydrodesulfurization catalysts, (ii) monometallic (Ni, Rh) and bimetallic NiRh catalysts supported on mixed and perovskite oxides in reactions of partial oxidation of methane and reforming of methane with CO<sub>2</sub> and (iii) catalysts for complete oxidation of ethanol, dehydration of glycerol and conversion of ethylene to propene. These different topics show that Dr. Palcheva is a researcher who works not only in the subject of her habilitation work, but also she has in-depth knowledge in the synthesis and characterization of catalysts with different applications in the field of catalysis. This is also confirmed by the fact that the candidate is an active participant in 9 research projects in various topics with different sources of funding, as in 3 of them funded by the EBR she is the head of the Bulgarian team.

## CONCLUSION

Documents and materials presented by Assist. Prof. Dr. Radostina Dimitrova Palcheva meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the corresponding rules for the implementation of the law in the Institute of Catalysis - BAS.

The obtained results based on the research activity of the applicant completely fulfilled the relevant additional requirements of IC-BAS for occupation of the academic position "Associate Professor". The scientific research is at a high level and fully corresponds to the topic of the announced competition.

**Therefore, I convincingly recommend to the members of the Scientific Jury and to the Scientific Council of the Institute of Catalysis - BAS to award to Assist. Prof. Dr. Radostina Dimitrova Palcheva the Academic Position “Associate Professor” in the field 4.2. Chemical Sciences, scientific research specialty "Chemical kinetics and catalysis".**

Sofia, 05.11.2020

Member of the Scientific Jury: .....

/Assoc. Prof. Dr. Stanislava Andonova, IGIC-BAS/