REPORT

on the materials submitted for participation in the competition for occupying the academic position Associated Professor

in the professional field 4.2 Chemical Sciences (Chemistry of the solid state, nanomaterials and minerals) for the needs of Department „Structural Crystallography and Materials Science“ at the Institute of Mineralogy and Crystallography - Bulgarian Academy of Sciences (IMC-BAS)

announced in the State Newspaper, issue 106 of 15.12.2020

Candidate: Assistant Professor, PhD Katerina Lubomirova Zaharieva, Institute of catalysis-BAS

Member of the Scientific Jury: Professor Christina Georgieva Vassileva, IMC-BAS

This Report was prepared in relation with the orders № 28РД09/12.02.2021 г. and № 35РД09/18.02.2021 of the Director of IMC-BAS, and the decision of the Scientific jury dated 23.02.2021 г. The only candidate applying in the competition is Assistant Professor Dr Katerina Lubomirova Zaharieva. The materials submitted by Dr Zaharieva for participation in the contest fully meet the requirements of the Rules of IMC-BAS for implementation of the Law for development of academic staff in the Republic of Bulgaria.

1. Brief analysis of the presented materials and quantitative indicators

The results achieved during the entire scientific activity of Dr Katerina Zaharieva in the period 2007-2020 are published in 69 scientific papers, among them – 29 in impact factor journals categorized in quartiles by WoS and Scopus (3 of them in Q1, 5 - in в Q2, 3 - in Q3 and 18 - in Q4). The results are also presented at 117 national and international scientific events (conferences, symposiums, and workshops). Dr Zaharieva has participated in 10 projects funded by sources outside BAS. According to the Scopus and WoS databases, candidate’s publications have been cited 84 times (auto-citations are excluded). The H-index of the applicant is 5.

Dr Zaharieva presents 54 publications for the academic position Associated Professor, and these publications do not repeat those submitted for her doctoral degree and academic position of Assistant Professor. Thirty-two of them are referred and indexed in the Scopus and WoS databases, and I found appropriate for the purposes of the present contest to accept only these 32 publications because they are listed in the “Report on the implementation of the minimum requirements for occupying the academic position Associated Professor”. Eleven of these publications comprise the candidate’s habilitation work (group B, №№ 4.1-4.11) thematically related to the synthesis of oxide nanomaterials with enhanced photocatalytic activity. Twenty-one of the papers presented (group G, №№ 7.1-7.21) are outside the habilitation work, and their focus is on the synthesis of different nanomaterials and investigation of their structure, phase composition and photocatalytic properties. All 32 publications are co-authored by three or more authors. The major contribution of Dr. Zaharieva to the most of these investigations is highlighted by the fact that she is a first author of 15, second author of 13, and third and subsequent author of 4 of these publications. The materials submitted for this contest ensure the following points for the candidate under all groups of indicators: Indicators “A” – 50 points (50 required); Indicators „B“ – 162 points (100 required); Indicators „G“ – 304 points (220 required); Indicators „D“ – 168 points (60 required).

The evaluation of the materials submitted shows that the scientific production of the applicant is in line with the topic of the contest, and Dr Zaharieva covers, and for some indicators significantly exceeds, the minimum national requirements, as well as the enhanced criteria of BAS for occupying the academic position Associated Professor in the professional field 4.2. Chemical Sciences.

2. Summary of the scientific achievements of the candidate

The scientific activity of Dr Zaharieva is basically related to synthesis of nanomaterials with enhanced photocatalytic activity and potential use in the environmental protection. The emphasis in her publications and her personal contribution is the application of different methods for synthesis and establishment of the optimal conditions for synthesis of nanomaterials with improved properties. Her scientific achievements can be assessed as enrichment of existing knowledge using new approaches, as well as finding and verifying new facts and relations for the processes studied.

2.1. Scientific achievements in the habilitation work. For the present competition, Dr Zaharieva presents 11 publications (B4.1-B4.11) as a habilitation work entitled: „Synthesis and investigation of oxide nanomaterials (oxides, mixed oxides, oxide-based composite material)". The basic achievements of the candidate consist in establishing the optimal conditions for synthesis by different methods (co-precipitation, mechanochemical activation, thermal treatment) of various nano-sized oxide and composite materials (Ni-, Cu-, Co-Cu-ferrites; TiO_2-CeO_2-ZnO composites; magnesium aluminate and magnetite type materials). The effect of synthesis method on the structure and morphology of the obtained materials is elucidated. A contribution is also declared in the interpretation of the analytical results on the characteristics and properties of synthesized materials, mostly from X-ray diffraction analysis, infrared spectroscopy and photocatalytic tests. It was found that the materials obtained had high photocatalytic activity and they can be used in different processes for environmental protection (mainly for purification of polluted waters).

2.2. Scientific achievements in publications outside the habilitation work. The scientific achievements outside the habilitation work are presented in 21 publications (G7.1-G7.21) and they can be grouped into several directions, namely:

(1) The photocatalytic activity of different materials (Zn, Ni и Ti-containing oxides, calcium titanate, abiotic and biotic materials, lepidocrocite, and и hybrid nanocomposites) is studied and compared using degradation reactions of model organic dyes as contaminants in aqueous solutions under UV-irradiation (8 publications). The applicant's contribution consists in establishing the effects of different variables, such as the type of precursors and precipitants used during synthesis; calcination temperature during thermal treatment; duration of mechanochemical activation; contents of dopants; etc. on the photocatalytic ability of the materials;

(2) Mechanochemical treatment is applied on number of materials (Zn oxide doped or not with Ag, Ni or Co; Ca titanate; and magnetite-type materials) in order to enhance their photocatalytic ability (4 publications). The influence and optimal values of different variables such as milling speed; mass ratio between balls and sample; temperature, time and environment of mechanoactivation; contents and type of dopants, on the photocatalytic activity of each material are experimentally established;

(3) The phase composition and/or crystal structure of oxide-based photo-catalysts are elucidated using X-ray diffraction analysis and infrared spectroscopy (3 publications);

(4) Synthesized by the applicant are materials with high catalytic activity (series of nano-sized ferrite materials, nano-sized goethite and lepidocrocite, composite nanomaterials based on Ni-oxide and Zn-oxide, etc.). Relations between methods of synthesis, structure and catalytic properties of the materials are established (9 публикации).

4. Recommendations and remarks

I have no remarks to Dr Zaharieva.

CONCLUSION

The analysis of documents submitted by the only candidate in this competition, Assistant Professor Dr Katerina Zaharieva, shows that she fully complies with the requirements for occupying the academic position "Associated Professor" according to Law for the development of the academic staff in Republic of Bulgaria and the Rules for its implementation, as well as with the respective regulations of BAS and IMC-BAS. The research topic of Dr Zaharieva is in line with the announced topic of the competition "Chemistry of the solid state, nanomaterials and minerals".

On the basis of the above considerations I give a positive assessment of the candidate's scientific achievements, and I convincingly recommend to the honorable members of the Scientific Jury to propose to the Scientific Council of IMC-BAS Assistant Professor Katerina Lubomirova Zaharieva to be elected on the academic position "Associated Professor" in the professional field 4.2. Chemical Sciences for the needs of Department „Structural Crystallography and Materials Science" at IMC-BAS.

16.04.2021 Signature: .....

/Prof Dr Christina Vassileva/