

## REPORT

**On the materials presented for the competition the academic position of a “Associate Professor” in the professional field 4.2 Chemical Sciences (Inorganic Chemistry) for the needs of the of laboratory “High temperature oxide materials” at the Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences (IGIC-BAS), declared in the State Gazette, issue 46/26.05.2023**

*Candidate (only one):* Assistant Prof. Dr. Maria Nikolova Gancheva (IGIC-BAS)

*Report:* Prof. Dr. Vilma Petkova Stoyanova, Institute of Mineralogy and Crystallography “Acad. Iv. Kostov”, BAS, Member of the Scientific Jury, appointed by order IGIC NoRD-09-131/17.07.2023

In the competition for the academic position (AP) “Associate Professor” in the professional field 4.2. Chemical Sciences (Inorganic Chemistry) (“State Gazette”, Issue 46/26.05.2023) participated one candidate - Assistant Professor Dr. Maria Nikolova Gancheva from the Laboratory “High Temperature Oxide Materials” at the Institute of General and Inorganic Chemistry (IGIC) - BAS.

### **1. Brief professional biography of the candidate and career progression**

Dr. Maria Nikolova Gancheva graduated in 2001 at the University of Chemical Technology and Metallurgy, Sofia. She graduated from the University of Chemical Engineering and Metallurgy, Sofia, in 2001 as a Master of Science in Chemical Technology with a professional qualification of Chemical Engineer. In 2007 she received the educational and scientific degree (PhD) “Doctor” from the Higher Attestation Commission in the scientific specialty “Construction materials and products and technology for their production” (Diploma № 31665/13.08.2007). “Comparative Studies on the Synthesis of Molybdate and Tungstate Phases Containing Zirconium and Nickel” as a full-time PhD student at the Institute of General and Inorganic Chemistry (2002-2005), BAS, in the scientific specialty: Inorganic Chemistry (code 01.05.02), Sofia.

In 2005 she started working as a chemist at the Institute of General and Inorganic Chemistry (IGIC) of BAS, and later in 2010 she fulfilled the conditions stipulated by the law and was appointed to the position of senior assistant professor at IGIC-BAS, which she has held until now. The applicant, Dr. M. Gancheva has 15 years of work experience in the last academic position of “Chief Assistant” (Certificate of experience in the academic position of “Chief Assistant” dated 12.06.2023 from IGIC-BAS).

An important stage in the scientific growth of Dr. Gancheva are numerous specializations in 2008 for 4 months at the University of Science and Technology, Krakow, Poland. In 2015-2017 at the University of Bergen, Department of Chemistry, Norway; several Erasmus+ grants for mobility of researchers for the purpose of training for the academic year 2017/2018 in the University of Technology in Poznań, in Institute of Materials Science and Engineering, Poznan, Poland; for the academic year 2018/2019 in the Josef Stefan Institute, Department of Electronic Ceramics, Ljubljana, Slovenia; for the academic year 2019/2020 at the Department of Inorganic Chemistry and the Institute of Materials Science and Engineering, Seville, Spain; for the academic year 2022/2023 at the Institute of Geotechnics, Slovak Academy of Sciences, Department of Mechanochemistry, Košice, Slovakia. The specializations in the prestigious international scientific institutes allowed her to acquire knowledge and skills in the field of synthesis and structural

characterization of inorganic glass-based materials and to fully meet the requirements of the competition for the position of “Associate Professor” in the professional field 4.2 Chemical Sciences (Inorganic Chemistry).

## **2. Report on the fulfilment of minimum requirements by groups of indicators for BAS and IGIC-BAS**

Dr. M. Gancheva is co-author of 28 scientific publications. In the current competition for the academic position “Associate Professor” 23 publications have been used, 22 of them are in the ISI database (IF) and one publication is from a conference (SJR). In the competition she participated with 10 scientific publications summarized as habilitation thesis (group of indicators B - Q1 rank- 5, 125 points; Q3 rank - 2, 30 points; Q4 rank - 3, 36 points; Total 191 points) and 13 publications outside the habilitation thesis (group of indicators D - Q1 rank - 4, 100 points; Q2 rank - 5, 100 points; Q3 rank - 2, 30 points; SJR - 1, 10 points; Total 240 points).

Some of the results of Dr. Gancheva's research have been presented at 21 national and international scientific conferences with oral presentations and poster presentations since 2008. The development of Dr. Gancheva's scientific and research activity was made possible by her participation in 5 scientific projects, one of which she is the leader (60 points). Dr. Gancheva's scientific publications have recorded 375 independent citations, 219 of which on publications participating in the competition for AP “Associate Professor” with a contribution of 438 points in the scientific metrics. The candidate's Hirsch index (h), according to the Web of Science database, is 10 and she has contributed 100 points in group G of the additional requirements of the IGIC-BAS.

From the submitted report on the fulfillment of the requirements under Article 5 of the Regulations on the conditions and procedure for the acquisition of scientific degrees and for the occupation of academic positions at IGIC-BAS, it is seen that in each of the indicators (A-50 points; B-191 points; D-240 points; E-438 points; G-160 points), the head as. M. Gancheva has a total number of points - 1079 and this number significantly exceeds both the minimum national requirements (400 points) and the higher criteria at BAS and IGIC (500 points) for holding the academic position “Associate Professor” in the professional field 4.2. Chemical Sciences.

## **3. General characteristic of the scientific research activity of Dr. M. Gancheva**

### ***3.1. Scientific contributions presented in the habilitation report***

*Solid-phase synthesis of tungstates by direct mechanochemical synthesis.* Dr. Gancheva's research publications are in the field of treatment of chemically insoluble oxide materials, which under the influence of high energy mechanical-chemical activation increase their reactivity by implementing of solid-phase synthesis to monophasic products. The objects of study are  $WO_3$  and oxides of divalent metals for direct mechanochemical synthesis to glasses with wolframite-type structure. In addition to investigating the conditions for solid-phase mechanochemical synthesis by varying the activation intensity, time, type and size of the milling bodies, the publications also discuss the results of characterizing the properties of the resulting glasses by powder X-ray diffraction, Infrared Spectroscopy, Diffuse Reflectance Spectroscopy and Photocatalytic tests. The prospectivity of the application of mechanochemical activation as an alternative, efficient and ecological synthesis method by varying the experimental conditions is demonstrated. The structural-phase and catalytic properties of the obtained glasses were also investigated.

*Direct mechanochemical synthesis of  $AWO_4$  with scheelite and wolframite type structure by a mixture of  $ACO_3+WO_3$ .* The conditions of preparation of  $BaWO_4$ ,  $CaWO_4$ ,  $SrWO_4$  (scheelite type structure) and  $ZnWO_4$  and  $CuWO_4$  with wolframite type structure from a mixture of

carbonates and tungsten oxide ( $\text{ACo}_3+\text{WO}_3$ ) by direct mechanochemical synthesis combining two types of activators (planetary ball mill and shaker SPEX 8000 Mixer Mill) were investigated, Variation of activation parameters - mechanochemical activation rate, duration, size of milling bodies, combination of mechanochemical and thermal treatment. As a result of the conducted, the optimum solid-phase synthesis conditions were determined.

*Solid-phase synthesis of  $\text{MgMoO}_4$  and  $\text{MgWO}_4$ .* The solid-phase synthesis of magnesium molybdate and tungstate was studied by a combined method of mechanochemical activation of the oxides and subsequent thermal treatment. It proves that the prior mechanochemical treatment of the precursors lowers the temperature and shortens the time for solid-phase synthesis.

### ***3.2. Scientific contributions presented in works outside the habilitation thesis***

In the presented publications, the processes of preparation of inorganic crystalline and amorphous phases by the methods of supercooled melt, mechanical-chemical solid-phase synthesis, co-precipitation and solid-phase reaction are investigated with the aim to establish the relationship between the synthesis methods and the structural properties of the obtained glasses. These methods have been applied to the study of solid-phase synthesis and phase transitions in zirconium molybdates and mixed zirconium molybdate-tungstate glasses, as well as in the  $\text{CaO-GeO}_2\text{-Li}_2\text{O-B}_2\text{O}_3$  system with possible doping with rare earth elements such as  $\text{Eu}^{3+}$ ,  $\text{Dy}^{3+}$ ,  $\text{Tb}^{3+}$ . The experiments carried out investigated the structure-phase transformations, morphology and optical properties of the obtained materials with a view to the perspective of their potential application and utilization of their useful properties in the field of optical materials and photocatalysis.

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

Dr. Maria Gancheva's publishing activity began in 2005 during the development of her PhD thesis. It has been successfully continued after her defence, including up to the present moment. Out of the 23 publications submitted for the competition for the post of Associate Professor, Dr. Gancheva is the first author in 14 of them (8 publications in indicator B and 6 publications in group D), in 4 she is the second author and in the rest she is the second author.

Of all the publications involved, nine have been published in international journals with Q1 rank, and three in the Journal of Alloys and Compounds, ranked 10th out of 155 journals in the field of Materials Science, specifically metals and alloys.

The personal contribution of Dr. Maria Gancheva in the conducted research is related to the methodology of the conducted experiments in the approaches for the selection of synthesis methods and the choice of a complex of analytical methods for the characterization of the obtained materials on their structural and photocatalytic properties.

In support of the high impact of Dr. Gancheva's scientific publications is the lack of evidence of plagiarism in her scientific works, which gives me reason to assume that the publications submitted for participation are the result of her personal involvement in their creation and Dr. Gancheva's personal contribution to them is indisputable.

## **5. Personal impressions**

I know Dr. M. Gancheva since the period of development of her PhD thesis. She is a researcher who has not only studied the mechanical-chemical activation method well since that period of her growth as a scientist, but has also successfully applied other learned methods and approaches to her research in inorganic materials science. She has expanded her area of expertise and is now an accomplished researcher capable of developing her own ideas and presenting high-

level scientific results to the scientific community. This is evidenced by her publications in prestigious highly ranked journals and her application to continue research in the scientific topic of complex oxide systems. In a personal capacity, Maria is a responsive and warm-hearted colleague who can always be counted on for help and assistance. I wish her every success.

## **6. Conclusion**

The documents and materials submitted by Dr. Maria Gancheva comply with all the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Implementation of the LDASRB and the relevant Regulations of BAS, as well as the specific requirements of the Institute of General and Inorganic Chemistry at BAS.

The candidate has submitted a sufficient number of scientific works published after the defence of the PhD. The submitted publications contain original scientific contributions, most of them having been published in journals with impact factor, published by international academic publishers.

On the basis of the above I give my positive assessment and recommend to the esteemed members of the scientific jury to make a proposal to the SC of IGIC-BAS for the election of Maria Nikolova Gancheva to the academic position of “Associate Professor” in the professional field 4.2. Chemical sciences, scientific specialty “Inorganic Chemistry” for the needs of the laboratory “High Temperature Oxide Materials” at the Institute of General and Inorganic Chemistry at the Bulgarian Academy of Sciences.

14.09.2023  
Sofia

Prepared the report: (s)

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