

## REVIEW

For the competition for the Academic position of Associate Professor  
In the professional field 4.2. Chemical Sciences (Inorganic Chemistry)  
for the needs of the Laboratory "High-temperature Oxide Systems" at IGIC-BAS  
declared in the Bulgarian State Journal, issue 36/03 May, 2019

**Candidate** (sole): Assistant Professor Albena Dimitrova Bachvarova-Nedelcheva, PhD

**Reviewer:** Prof. Dr. Boris Lubomirov Shivachev, IMC-BAS; Member of the Scientific Jury,  
appointed by order 457 PД-09-83 / 01 July 2019 of the director of IGIC-BAS.

The candidate for the position Associate Professor Albena Dimitrova Bachvarova-Nedelcheva, PhD has presented all the required documents in print and electronic (CD) formats, in accordance with "Law for the development of the academic staff in the republic of Bulgaria" (LDASRB), the "Regulations for the application of the LDASRB" (RALDASRB) and "Statute for the conditions and procedures for the acquisition of scientific degrees and for the appointment of academic position in IGIC - BAS", related to the procedure for competitive selection and nomination at the academic position "Associate Professor".

### **I. Applicant's personal and professional information**

Albena Bachvarova-Nedelcheva is a PhD with more than 14 years of work experience at IGIC - BAS and currently (as of February 2010) holds the position of Assistant Professor in the Laboratory "High Temperature Oxide Systems" of IGIC - BAS. In 2000 she completed a specialization in Glass and Ceramics at the University of Aveiro, Portugal and in 2005 received a PhD Doctorate degree after defending a dissertation named "Glass Formation and Phase Formation in Selenite Systems of  $\text{SeO}_2\text{-Ag}_2\text{O-M}_n\text{O}_m$ ,  $\text{SeO}_2\text{-CuO-M}_n\text{O}_m$  ( $\text{M}_n\text{O}_m=\text{B}_2\text{O}_3, \text{MoO}_3$ )" under the supervision of Prof. DSc Y. Dimitriev. Dr. Albena Bachvarova-Nedelcheva is actually an active member of the Union of Chemists in Bulgaria and of the Bulgarian Crystallographic Society. Dr. Albena Bachvarova-Nedelcheva's extensive scientific, R&D and pedagogical activities are reflected in the scientific literature mainly in the form of scientific papers and communications (61 in total and 41 from those in peer reviewed journals with impact factor), participation in scientific forums (conferences, symposia, schools, etc.) – 58 in total featuring 21 national. Dr. Albena Bachvarova-Nedelcheva's has participated in 10 funded scientific projects on a competitive bases and helped the realization of MSc graduates and PhD students either as a supervisor or scientific consultant. She has experience in the peer review and in organization of

activities of scientific events. In the databases the contribution (manuscripts) with the participation of Dr. Albena Bachvarova-Nedelcheva, have received at least 307 quotes (up to 22 August 2019) producing a Hirsch index of 10 (self citations of all authors excluded) based on Scopus.

## **II. General description of the presented materials for the competition**

Presented by Dr. Albena Bachvarova-Nedelcheva materials are in accordance with the topic of the competition "High temperature oxide systems". The presented "Information for the scientific contributions" is in line with the results published in the presented scientific communications.

Dr. Albena Bachvarova-Nedelcheva is applying in the competition for the position of Associated Professor with 28 scientific publications in international peer reviewed journals distributed as follows: 10 papers for Indicator B (according to LDASRB) and 18 for Indicator G (Г in Bulgarian). All 28 communications are referenced in Web of Science and/or Scopus, 23 of them are published in peer reviewed journals with impact factor. A total of 206 citations of scientific communications were noted. The Hirsch's index (h) of the submitted 28 works is 8 (self citations of all authors excluded). For the competition Dr. Albena Bachvarova-Nedelcheva's scientific work related to "High-temperature Oxide Systems" at IGIC-BAS was supported by three research projects: Synthesis of amorphous, nanostructured molybdate materials (TC-X-1718/07), Nanostructured multicomponent bismuth borate glasses and glass ceramics (DNTS / INDIA 01/6) and Synthesis, structure and luminescent properties of tungsten glasses containing Nb<sub>2</sub>O<sub>5</sub> (KP-06-H29 / 7). Since 2005, Dr. Albena Bachvarova-Nedelcheva has successfully supervised three MSc students and has been a consultant to three PhD students.

## **III. Compliance with the Minimal National Requirements under LDASRB article 2b and RALDASRB Art. 1, Art. 1a and Table 1**

The assessment of the compliance with the "Minimum national requirements for scientific, teaching and/or artistic or sports activity for 4. Natural sciences, mathematics and informatics and Professional field 4.2. Chemical Sciences" of the materials presented by Dr. Albena Bachvarova-Nedelcheva is based on the LDASRB and RALDASRB and the "Statute for the conditions and procedures for the acquisition of scientific degrees and for the occupation of academic positions in IGIC - BAS", related to the procedure for competitive selection and nomination at the academic position "Associate Professor" are outlined in Table 1.

With the exception of the first Indicator A (related to the Thesis for the award of educational and scientific degree "Doctor" e.g. PhD) the table reveals that with the submitted materials Dr. Albena Bachvarova exceeds at least two times the minimal criteria (points) required for the academic position "Associate professor".

**Table 1.** Assessment of the Minimum required indicators/points required for the appointment at the academic position of Associate Professor according to the LDASRB, RALDASRB and the "Statute for the conditions and procedures for the acquisition of scientific degrees and for the occupation of academic positions in IGIC - BAS", related to the procedure for competitive selection and nomination at the academic position " (according to the submitted materials of the competition) by Associate Professor" Dr. Albena Bachvarova – Nedelcheva.

Indicators		Position	Position.	Dr. Albena Bachvarova - Nedelcheva
		Assoc. Prof.	Assoc. Prof.	
		RALDASRB	IGIC - BAS	
A	Indicator1/Показател 1	50	50	50
Б	Indicator1/Показател 2	-	-	-
В	Indicators 3and 4 Показатели 3 или 4	100	100	210
Г	Sum of indicators 5-10 Сума от показателите от 5 до 10	200	220	250
Д	Sum of points in indicator 11 Сума от точките в показател 11	50	60	412
Е	Sum of Indicator 12 to the last Сума от показателите от 12 до края	-	-	-
Ж*	Statute IGIC - BAS	-	70	120

\* The additional requirements of IGIC - BAS according to Art. Article 1a &. 3 of RALDASRB.

Officially the scientific materials submitted for participation in the competition by Albena Bachvarova - Nedelcheva and their reflection in the scientific literature fully cover the minimal

LDASRB, RALDASRB and additional requirements ("Statute for the conditions and procedures for the acquisition of scientific degrees and for the occupation of academic positions in IGIC - BAS") for the appointment at the Position. Assoc. Prof.

#### **IV. Characteristics of the scientific, applied and pedagogical activity and values of the submitted materials for the competition and their reflection in the scientific literature**

Dr. Albena Bachvarova-Nedelcheva is participating in the competition with 28 scientific publications in international journals, from those 23 are with impact factor (JCR impact factor, Clarivate). The value of the scientific communications becomes clearer from their breakdown by the quartile rank of the journals (Q): 5 articles in journals Q1, 6 in Q2, 7 in Q3 and 5 in Q4. The total impact factor of the articles presented by Dr. Albena Bachvarova-Nedelcheva for the competition is 18.3, while the average is 0.84. The comparison of Q vs IF reveals that for the present competition the IF is an underestimation. In 14 of the scientific papers Dr. Albena Bachvarova-Nedelcheva is the first author (articles B1, 3, 4 and 6-10, D 6, 7, 9, 15, 17, 18 from the list), and in 17 articles – an author of correspondence (Articles B1-5, 7, 9 and 10, G2, 6, 9-11, 13, 15-18 from the list), which shows scientific development and that the leading role in the research has already been initiated.

Dr. Albena Bachvarova-Nedelcheva's articles have reached a wide scientific audience. So far, total of 307 citations have been noticed, 206 of which are associated with the papers for the present competition. Those numbers significantly exceed (almost 6 times) the required indicators/points in the RALDASRB. From the presented list of citations, it is evident that Dr. Albena Bachvarova-Nedelcheva has a Hirsch index of 12 and a Hirsch index of 10 based solely on the competition materials (as of 22.08.2019). The distribution of the citations of the manuscripts with which Dr. Albena Bachvarova-Nedelcheva participates in the competition is as follows: 202 in articles in scientific journals; 4 in chapters of books published abroad or in conference materials. Special attention should be paid to articles  $\Gamma$ 7 and  $\Gamma$ 8 from the list, which are cited 43 and 33 times respectively. The results of the research have been reported 58 times in scientific forums both at home and abroad, including four papers and two awards.

Dr. Albena Bachvarova-Nedelcheva and has participated in three research projects funded by the NSF: Synthesis of amorphous, nanostructured molybdate materials (TK-X-1718/07), Nanostructured multicomponent bismuth-borate glasses and glass-ceramic structures (DNTS / INDIA 01/6), and glass-ceramic structures properties of tungsten glasses containing Nb<sub>2</sub>O<sub>5</sub> (KP-06-H29 / 7) demonstrating the ability to identify, defend and successfully solve a specific

scientific problem. She has participated in the realization and implementation of the tasks of 7 other projects, one of them international. The diversity of employed research methods used in the scientific communications and projects with the participation of Dr. Albena Bachvarova-Nedelcheva speak of a wide interdisciplinary knowledge and practical experience.

The pedagogical activity of Dr. Albena Bachvarova-Nedelcheva includes the supervise of three MSc graduates from UCTM-Sofia. She has been also a consultant to three PhD students at UCTM-Sofia and IGIC - BAS.

## **V. Main scientific and applied contributions based on the submitted materials for the competition**

Dr. Albena Bachvarova-Nedelcheva is clearly a scientist with experimental affinity and with contributions in both the scientific and applied fields.

The main part of the production of Dr. Albena Bachvarova-Nedelcheva falls into three directions:

1. Synthesis of selenite glasses;
2. The use of sol-gel synthesis in the preparation of  $\text{TiO}_2$  nanosized powders with the participation of different network formers;
3. Structural characteristics of new materials.

The first area, Synthesis of Selenite Glasses, includes scientific publications B1-10 from the list of works associated with a habilitation and works G16-18 from the list of manuscripts outside of habilitation work. The research in this area is a natural continuation of the PhD thesis work on "Glass Formation and Phase Formation in Selenite Systems of  $\text{SeO}_2\text{-Ag}_2\text{O-M}_n\text{O}_m$ ,  $\text{SeO}_2\text{-CuO-M}_n\text{O}_m$  ( $\text{M}_n\text{O}_m = \text{B}_2\text{O}_3, \text{MoO}_3$ )". The manuscript after 2005 reflect on the synthesis and characterization of new multicomponent selenite systems, production of glasses, growth of crystalline phases and investigations on the optical properties of the compounds. Works B1, 4, 5, 6 and 7 reflect on the synthesis and tendency of glass formation in four systems:  $\text{SeO}_2\text{-Ag}_2\text{O-MoO}_3$ ,  $\text{SeO}_2\text{-CuO-MoO}_3$ ,  $\text{SeO}_2\text{-Ag}_2\text{O-B}_2\text{O}_3$  and  $\text{SeO}_2\text{-CuO-B}_2\text{O}_3$  obtained by melting in evacuated quartz ampoules (vacuum sealed) and by using different cooling rates. Works B2 and B3 focus on the study of selenite systems using different "melting" approaches: melting in ampoules, air, and in an autoclave (e.g. at pressure of  $P = 35 \text{ MPa}$ ) as the chemistry of the compositions is expanded by  $\text{TeO}_2$ ,  $\text{V}_2\text{O}_5$ ,  $\text{ZnO}$ , and  $\text{Nb}_2\text{O}_5$ . Works B8-10 focuses on optical studies aiming at specifying the ranges for actually employing the synthesized substances. The works G16-18 can be referred to both of the discussed area by adding the sol-gel synthesis

method. In the case of Dr. Albena Bachvarova-Nedelcheva, the systems are  $x\text{TiO}_2$ ,  $(1-x)\text{SeO}_2$  and  $x\text{TiO}_2.y\text{TeO}_2.z\text{SeO}_2$  ( $x + y + z = 1$ ) while alternative synthesis techniques are applied. The results of studies of the above selenite systems show that the short order (network) of the glasses is mainly determined by the  $\text{SeO}_3$ ,  $\text{MoO}_x$  ( $x = 4$  or  $6$ ) structural units. The role of the modifying ions ( $\text{Ag}^+$  and  $\text{Cu}^{2+}$ ) has been recognized: at low concentrations, partial degradation of the structure of the network-forming agents ( $\text{SeO}_3$  and  $\text{MoO}_3$ ) takes place, but at the same time a sufficient number of O-bridges between the polyhedra remain. As the concentration of  $\text{Ag}^+$  and  $\text{Cu}^{2+}$  increases, the degradation of the short range "structure" increases, with the systems dominated by isolated  $\text{SeO}_3$  and  $\text{MoO}_x$  groups, which in the process of cooling benefit the crystallization processes. In general, the substitution of  $\text{MoO}_3$  with  $\text{B}_2\text{O}_3$  broadens the limits of crystallization (narrows the glass formation region). The simultaneous presence of silver ions ( $\text{Ag}^+$ ) and isolated  $\text{SeO}_3$  groups facilitates the formation of crystalline  $\text{Ag}_2\text{SeO}_3$ , (replacing  $\text{Ag}^+$  with  $\text{Cu}^{2+}$  further hampers glass formation). The presence of  $\text{B}_2\text{O}_3$  in the system is a condition for hydration – which should be avoided.

The experiments with the use of high pressures in the preparation of selenite glasses, showed that the method is suitable for synthesis especially for systems containing transition metal oxides in order to achieve a high oxidation state. It was concluded that melting in evacuated (quartz) ampoules is suitable for a wider range of compositions, and permits changes in the cooling rate of the melts, operations at different melting/heating temperatures, i.e. more parameters are available to control glass formation and avoid the crystallization processes.

Work on indicator G (Gc1 to 18) are related to the application of different sol-gel synthesis techniques (hydrolytic, non-hydrolytic and the so-called combustion method in the preparation of  $\text{TiO}_2$  nano-powders with the participation of classical ( $\text{B}_2\text{O}_3$ ), intermediate ( $\text{ZnO}$ ) and non-traditional glass formers ( $\text{TeO}_2$ ,  $\text{SeO}_2$ ) in two- and three-component systems.

In Works G3, 7, 8, 9, 12, 14, 17, in addition to the synthesis, studies were also conducted on the antibacterial properties of  $\text{TiO}_2$  containing nanopowders. Among them, works G7 and G8 stand out with a total of 76 citations (from a total of 206 citations). Photocatalytic tests of synthesized nanosized powders against model dyes Malachite Green and Reactive Black D1, 2, 3, 5, 6, 12 and 17.

## **VI. Critical notes and comments**

A series of repeated use identical diagrams and figures in various articles are noted. For example, Figure 2.2 of work G5 (2013) is also featured in work G7 (2013) (Figure 1b), Figure 3 of work G3 and Figure 2 of work G8, Figure 2. 3 G6 and Figure 2B of G9., Figure 6a G16 and

Figure 5b of G18. Although the discussion is correct in the context of publications, it is undoubtedly possible for authors to avoid such practices in the future.

I also have some stylistic notes. The evaluation the documents requires analysis and breakdown of scientific data. For example the rank of journals is specified but no mention is made of which database it is taken (Scopus or Web of Science), the documentation includes a list of articles without giving the impact factor of the journals for the year. A good impression is achieved when the attached lists follow a certain format, which is largely preserved in this case.

In reality, these small critical remarks do not in any way undermine the high quality of the scientific and applied production of Dr. Albena Bachvarova-Nedelcheva.

The question is related to the "longevity" of the scientific subject. What are the criteria, indicators.... etc. that Dr. Albena Bachvarova-Nedelcheva is focusing for assessing the potential for realization, starting and/or continuation of a specific scientific topic? And what when choosing a new scientific topic? What is the future assessment of the specific topics of indicators W and G?

## **VII. Conclusion**

It is obvious to me that Assistant Professor Albena Bachvarova-Nedelcheva, is a productive researcher with established qualities and a promising career. Considering the scientific and applied achievements of the applicant, the relevance and prospect of the future scientific research, the organizational activity and personal qualities and skills, I strongly recommend the Scientific Council of IGIC - BAS to choose and appoint

**Albena Dimitrova Bachvarova-Nedelcheva, PhD**

the academic position "Associate Professor" 4. Natural sciences, mathematics and informatics, professional field 4.2. Chemical Sciences (Inorganic Chemistry) at IGIC -BAS.

Sofia, 22.08.2019 г.

prof. B. Shivachev, PhD