ATTITUDE OF THE REVIEWER

by Prof. Daniela Georgieva Kovacheva -
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For the Competition for occupation of the academic position "Associate Professor" in the professional field "Chemical Sciences", code 4.2, for the needs of the Laboratory "High-temperature Oxide Systems" at IGIC-BAS, announced in SG, issue. 36 of 03/05/2019

Documents of one candidate have been submitted for participation in the announced competition, namely Assistant Prof. Dr. Albena Bachvarova-Nedelcheva, IGIC-BAS

1. General characteristics of the materials presented

Assistant Professor Albena Bachvarova-Nedelcheva received her master's degree in 2000 from the University of Chemical Technology and Metallurgy - Sofia, majoring in Materials Technology and Materials Science. She defended a doctoral dissertation on the topic "Glass Formation and Phase Formation in Selenite Systems of the Type SeO_2-Ag_2O- M_nO_m, SeO_2-CuO-M_nO_m (M_nO_m = B_2O_3, MoO_3) ". She went to work at IGIC-BAS in 2005, where she still works. The candidate's total number of articles is 61, 4 of which are included in her doctoral thesis. The total number of citations is 307. The publications with which Dr. Albena Bachvarova-Nedelcheva participated in the competition are 28, 10 of them were presented as habilitation work (210 points) and 18 - outside it (250 points). Of these articles, 5 are in journals in the first quartile Q1 and 7 in the second Q2. The number of citations on articles submitted for participation in the competition is 206. The applicant's participation in international, foreign and national conferences is 62. She is participant in the teams of 3 national scientific projects. The candidate's Hirsch index on all publications is 12, and on those for participation in the competition - 9.With these indicators the materials presented by Dr. Albena Bachvarova-Nedelcheva exceed many times the national minimal requirements (according to Article 29b of the Law for the development of the academic staff in the Republic of Bulgaria), BAS (Article 2 of the Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions) in BAS) and the additional requirements of IGIC (Art. 3, Para. 13, Art. 28, Para. (6) a, of the Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at IGIC).

2. Principal scientific and/or applied contributions

Contributions to the synthesis and structural characterization of selenite glasses, as well as the production of crystalline phases in three- and multi-component selenite systems, cover publications (1,4,5,7) from the habilitation work. In this regard, new non-traditional selenite glasses were synthesized and the tendency for glass formation in four systems SeO_2-Ag_2O-MoO_3, SeO_2-CuO-MoO_3, SeO_2-Ag_2O-B_2O_3 and SeO_2-CuO-B_2O_3 was systematically investigated. For the first time, the fields of glass formation in these systems have been identified and it has been shown that the close order of glasses is mainly determined by the SeO_3, MoO_6 and MoO_4 structural units. The main and most interesting results obtained in MoO_3 systems are summarized as a developed structural model and a hypothesis has been raised that the peculiarities of amorphous network formation are related to the existence of upper and lower boundaries of glass formation. The specific role of Ag^+ and Cu^{2+} modifiers in the degradation of the amorphous SeO_2-MoO_3 network has been established. Works 2 and 3 contribute to the elucidation of thermal stability and the formation of microheterogeneous structures in multicomponent selenite glasses obtained by various methods. SeO_2-rich glasses have been found to be thermally stable up to 300^oC and suitable for optical filters. By heating these glasses at low temperatures in air (150°C), microheterogeneous structures were obtained

with the participation of silver nanoparticles with sizes from 30 to 100 nm. Important conclusions have been drawn as to the applicability of the various techniques for the synthesis of selenite glasses: Synthesis in evacuated quartz ampoules is suitable for a wider range of compositions since the aggregation processes can be controlled by this method; Synthesis in air atmosphere is a multistage process that reduces the sublimation of SeO_2; High-pressure synthesis is specifically designed for selenite glasses and is suitable for systems containing transition metal oxides in order to achieve their high oxidation state. The contribution of publications (8, 9, 10) is related to obtaining, characterizing and investigating the optical properties (absorption edge and gap band width) of multicomponent glasses containing simultaneously SeO_2, TeO_2, as well as other conditional network formers (Nb_2O_5, MoO_3, V_2O_5). The results obtained also contribute significantly to clarifying the composition-synthesis-structure-property relationship. The studies open the possibility for obtaining new multicomponent compositions containing SeO_2 with potential optical applications.

Most of the studies in publications outside of the habilitation work are fundamental and reveal the possibilities of applying sol-gel synthesis in the preparation of TiO_2 containing nanoscale powders within two- and three-component systems (works 1 to 18). Publications (3, 12, 14, 17) present studies on the antibacterial properties of TiO_2 containing nanopowders, and other 4 papers (3, 6, 9, 17) focus on photocatalytic studies of the same materials, which point to the application focus of the studies carried out by the applicant. The main contributions can be classified as: The conditions for the preparation of nanosized two- and three-component powders containing TiO_2 by several sol-gel techniques were investigated; Hydrolytic, non-hydrolytic, and solution combustion, and found to be the most suitable for the preparation of nanosized powders is the method by combustion from a solution; Appropriate combination of different but compatible network generators has been shown to produce monolithic and transparent three-component gels; Original combinations of initial compounds were selected for the synthesis of nanosized powders, with interesting photocatalytic and antibacterial properties; Amorphous hybrid TiO_2 containing materials in three-component systems with the participation of different types of network formers are obtained; It has been confirmed that mechanochemical activation is promising method for the development of multicomponent materials for photocatalytic applications.

I know personally Dr. Nedelcheva, who came to me for analyzes and I have excellent impressions of her thorough knowledge, accuracy and correctness in conducting experiments and interpreting the results.

3. Conclusion

All presented above describes Dr. Nedelcheva as a well-established specialist with knowledge and skills in the field of synthesis and characterization of glass and nanosized materials with optical, photocatalytic and antibacterial properties with practical interest. **This gives me great conviction to recommend to the Honorable Jury to elect Dr. Albena Bachvarova-Nedelcheva, for academic position "Associate Professor" in the professional field 4.2. Chemical sciences.**

Sofia, August,14, 2019 Signature:

(Prof. Dr. Daniela Kovacheva)