OPINION

of PhD Thesis of Dimitar Nikolaev Shandurkov

PhD student of independent training in the Department of Phiscichemistry

Faculty of Chemistry and Pharmacy, SU „St. Kliment Ohridski“,

Scientific specialty 4.2 – „Chemistry“ – Phisicochemistry

от ***Assoc. Prof. Albena Bachvarova-Nedelcheva***, Institute of General and Inorganic Chemistry - BAS,

member of the juri according to **order №РД-38-591/30.09.2024г.**

1. Biographical data, general presentation of the materials, structure and presentation of the dissertation work

PhD student Dimitar Shandurkov was born in Gabrovo. He completed his secondary education at PMG, Lovech, and in 2018 received a bachelor's degree at the Faculty of Chemistry and Pharmacy (FCH) of SU "St. Kliment Ohridski". In 2019 completed his master's degree again at FHF, specialty Functional Materials. In 2016, he was enrolled as a PhD student of independent training under the supervision of Prof. Dr. Stoyan Gutsov. He has been an assistant since November 2022. By leading laboratory and seminar exercises in Physicochemistry and colloid chemistry and specialized courses in ceramic and optical materials.

The doctoral student has submitted the necessary materials, properly prepared and meeting all the requirements for the defense of the dissertation.

The structure of the dissertation work includes six chapters that logically follow the stages of the research activity and essentially present the activity performed by the PhD student. The conclusion, the main contributions of the study, as well as the attached list of references (205 sources) are separated structurally. The dissertation research is presented on 120 pages. of which 101 p. are the main text. It includes 51 figures and 9 tables.

2. Relevance of the topic and appropriateness of the set goals, tasks and research methods

The dissertation is focused on luminescent composite materials, which are an interesting class of materials and a very promising and developing area of materials science. Hybrid composite materials based on silicate aerogels and luminescent complexes containing europium and terbium were obtained for the fulfillment of its objectives. The main task of the doctoral student is related to obtaining materials that combine the chemical resistance of silicates, the low thermal conductivity of

aerogels and provide a matrix that protects the luminescent components from the environment - moisture, temperature and various mechanical effects.

The main objective of the dissertation is correctly formulated, the research tasks are clearly set and connected, and follow a logical sequence. There are six formulated tasks and they could be conditionally divided into three groups - methods for obtaining silicate aerogels, characterization of the silicate matrix and a detailed study of the spectral properties of the obtained composite materials.

The research methods are correctly selected and ensure the achievement of the set goal and the tasks arising from it.

3. Characterization and evaluation of the dissertation work

The presented dissertation deals with issues related to revealing the relationship between properties and structure of aerogel granules containing complexes of rare earth ions with phenanthroline, focusing on the influence of the matrix on the luminescent properties of the composite materials. The research methods used, the materials collected and processed, as well as the sequence of conducting the research in the dissertation are precisely and precisely described. The PhD candidate demonstrates excellent skills in the collection, processing and analysis of literature and experimental data. Own research is presented clearly, illustrated with figures and tables, represents original research of the doctoral student and is in accordance with the set goals and objectives.

Experimentally, a series of silica aerogel matrices with different degrees of hydrophobicity were synthesized and for their characterization, a special methodology was developed to study their hydrophobicity, as well as their textural properties. A good impression is also made by the detailed study of the photophysical properties of the obtained luminescent composite materials. Luminescent properties of europium and terbium ions are shown and analyzed. The conclusions drawn regarding the influence of the hydrophobicity of the matrix on the luminescence properties of the embedded hybrid complexes reveal the in-depth knowledge of the problem and the skill of the doctoral student to analyze the obtained results.

In general, the development of the doctoral student is a carrier of novelty as an idea and realization, skills for analysis and forecasting of future development of the idea, correctness as implementation and presentation.

I have the following two recommendations:

1. It would be good if the pages of the individual chapters were indicated in the table of contents, which would greatly facilitate the reviewers;

2. I believe that work would benefit if the literature review was presented more concisely and summarized, with the inclusion of tables presenting the work done so far in similar systems.

4. Contribution analysis

The research results have been promoted in an appropriate way and to a sufficient extent, having been presented at 2 national and 2 international scientific forums and published in 3 refereed journals. The appearance of citations on recently published works is proof of the relevance of the researched questions and of the achievements during the work.

5. Promotion of scientific research

The research results have been promoted in an appropriate way and to a sufficient extent, having been presented at 2 national and 2 international scientific forums and published in 3 refereed journals. The appearance of citations on recently published works is proof of the relevance of the researched questions and achievements during the work.

6. Conclusion

The work performed is significant in volume and diverse in nature, which gives reason to assume that the doctoral student has gained sufficient experience and abilities to conduct independent scientific work in the field of materials science and physicochemical research of new materials. The documents presented for defense cover all the requirements of the RSARB, the Regulations for its implementation and the Recommended requirements for obtaining scientific degrees of SU "St. Kl. Ohridski".

Everything said above motivates me to give, without hesitation, a positive assessment of the dissertation work and to support the awarding of the educational and scientific degree "doctor" to Mr. Dimitar Nikolaev Shandurkov.

20.11.2024 Assoc. prof. d-r Albena Bachvarova - Nedelcheva

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