OPINION

by Prof. Petya Dimitrova Tsvetkova, DSc

Faculty of Medicine

Burgas State University "Prof. Dr. Assen Zlatarov",

Field of higher education 4. Natural Sciences, Mathematics and Informatics,

Professional field 4.3. Biological Sciences

on a dissertation thesis for the scientific degree "Doctor of Sciences",

entitled "Structure and Functional Properties of Oxoselenates (IV, VI)",

Field of higher education: 4. Natural Sciences, Mathematics and Informatics, Professional field:

4.2. Chemical Sciences, Scientific specialty: Inorganic Chemistry

submitted by Prof. Rumyana Zlatinova Yankova-Avramova, PhD

I have been appointed as a member of the Scientific Jury in accordance with Order No. UD-583/19.12.2025 of the Rector of Burgas State University "Prof. Dr Assen Zlatarov". All materials related to the dissertation were received in electronic form.

I. General Overview of the Procedure

The submitted set of materials complies with the Act on the Development of Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for its Implementation (RIADASRB), and Article 43, paragraph 3 of the "Rules for the Conditions and Procedure for Awarding Scientific Degrees and Holding Academic Positions at Burgas State University "Prof. Dr. Assen Zlatarov" for the acquisition of the scientific degree "Doctor of Sciences", and includes the following documents:

- ✓ **Application to the Rector of Burgas State University "Prof. Dr Assen Zlatarov" for the initiation of a procedure for awarding the scientific degree "Doctor of Sciences".**
- ✓ **Curriculum vitae** – signed by the candidate.
- ✓ **Copy of the diploma** for the awarded educational and scientific degree "Doctor".
- ✓ **Dissertation thesis** for the scientific degree "Doctor of Sciences".
- ✓ **Abstract of the dissertation thesis**: in Bulgarian and in English.
- ✓ **Statement of the scientific and scientific-applied contributions** of the dissertation thesis.
- ✓ **List of scientific publications related to the dissertation thesis**, including: full bibliographic descriptions and information on indexing (Scopus, Web of Science).

- ✓ **Copies of the scientific publications** included in the dissertation thesis.
- ✓ **Statement on the fulfilment of the minimum national requirements** under the Regulations for the Implementation of the Act on the Development of Academic Staff in the Republic of Bulgaria (RIADASRB) and the minimum requirements under the Regulations on Academic Staff at Burgas State University "Prof. Dr Assen Zlatarov".
- ✓ **Statement of citations** – prepared on the basis of data from Scopus and Web of Science.
- ✓ **Declaration of originality and authorship** of the dissertation thesis.

2. Brief Biographical Information

Prof. Dr Rumyana Yankova-Avramova is an established Bulgarian scientist and university lecturer in the field of chemical sciences, with a long-standing academic career at the Burgas State University "Prof. Dr Assen Zlatarov". She completed her higher education in 1990, obtaining a Master's degree (Engineer-Chemist), along with an additional qualification in Pedagogy. She was awarded the educational and scientific degree "Doctor" in 2015 at Angel Kanchev University of Ruse.

Her scientific and teaching activities cover key areas of inorganic and applied chemistry, chemical education, and the environmental assessment of chemical factors in both the general and occupational environment. She delivers a wide range of fundamental and applied academic courses and has made a significant contribution to the development of curricula and educational programmes in chemistry.

She is the author of more than 130 scientific works, including internationally recognized publications, one monograph, and numerous textbooks and teaching aids. Her scientific output has been cited in leading international scientific databases, with a Hirsch index (h-index) of 15.

Prof. Dr Yankova-Avramova has played an active role in academic governance and scientific expertise: she has served as Head of Department, Vice-Dean and Dean of the Faculty of Medicine, participated in national and international projects, and been a member of editorial boards and expert councils. Since 2023, she has been a member of the research team at the National Center for Biomedical Photonics.

3. Relevance of the Topic

The relevance of the dissertation is determined by the growing scientific and applied interest in selenium-containing compounds, particularly oxoselenates (IV, VI), which represent an important class of inorganic materials with rich structural diversity and a wide range of functional properties. In modern inorganic chemistry, the targeted design of substances with predefined

characteristics is gaining increasing importance, requiring a deep understanding of the relationship between chemical composition, crystal structure, and physicochemical properties.

Oxoselenate compounds have potential applications in several priority scientific and technological fields, such as photonics, optoelectronics, nonlinear optics, catalysis, energy technologies, and biomedicine.

The relevance of this research stems from the need to expand the existing experimental and theoretical database for selenite and selenate compounds, including poorly studied or newly synthesized structures. The combination of modern experimental methods with quantum chemical modeling and analysis of biological activity fully aligns with current interdisciplinary trends in chemistry and materials science.

In this context, the dissertation is timely, scientifically significant, and aligned with current directions in the development of fundamental and applied chemical science, contributing to the deepening of knowledge and the discovery of new prospects for the practical application of oxoselenate systems.

4. Characterization and Evaluation of the Dissertation Thesis

The dissertation thesis of Prof. Dr Rumyana Zlatinova Yankova-Avramova represents a comprehensive, in-depth, and scientifically well-founded study dedicated to the synthesis, structural characterization, and investigation of the physicochemical and functional properties of oxoselenate compounds. The topic is both timely and significant from the perspective of fundamental chemical science as well as potential applications in materials science, photonics, and biomedicine.

The dissertation comprises an impressive volume of 391 standard pages, illustrated with 75 tables and 117 figures, which attests to the scope and depth of the conducted research. The presentation is clearly structured and logically coherent, including an introduction, a detailed literature review, an experimental section, an extensive "Results and Discussion" chapter, and summarized scientific and applied contributions. This structure ensures a systematic presentation of the research concept and facilitates tracing the connections between the objectives, employed methods, and obtained results.

The literature review is exceptionally thorough and critically constructed, encompassing 339 references, including leading publications in international scientific journals. This demonstrates the author's excellent awareness of the current state of research on selenium-containing compounds and allows a convincing positioning of the dissertation within the context of contemporary scientific directions. The unresolved problems and scientific challenges justifying the research are clearly outlined.

The experimental part is distinguished by high methodological rigor and scientific accuracy. A wide range of modern synthetic, analytical, and spectroscopic methods has been employed, complemented by quantum chemical calculations and biological tests. The selection of methods is appropriate for the objectives, and their detailed description guarantees the reproducible and reliability of the results.

The "Results and Discussion" section forms the core of the dissertation and is its largest part. It is marked by high scientific value, analytical depth, and a clearly expressed interdisciplinary approach. Prof. Yankova does not limit herself to a descriptive presentation of the results but conducts an in-depth comparative analysis, revealing patterns and correlations between chemical composition, crystal structure, electronic organization, and functional properties of the studied oxoselenate systems. Particularly noteworthy is the successful integration of experimental data with theoretical models and biological results.

The formulated conclusions and summarized contributions are a logical and direct outcome of the presented results. They clearly reflect the original character of the research and attest to a high degree of scientific independence, analytical thinking, and research maturity of the author. The dissertation significantly contributes to expanding knowledge in the crystal chemistry of oxoselenate compounds and uncovers new possibilities for their practical application.

In conclusion, the dissertation is characterized by a high scientific level, methodological precision, and significant contribution to contemporary chemical science. It fully meets the requirements for awarding the scientific degree "Doctor of Sciences" and represents a convincing proof of the scientific potential and professional competence of its author.

5. Evaluation of the Publications Related to the Dissertation Thesis

The scientific publications submitted as part of the dissertation thesis and the report on fulfilling the minimum national requirements demonstrate a high, consistent, and thematically coherent scientific productivity by Prof. Rumyana Zlatinova Yankova-Avramova, PhD fully meeting the criteria for awarding the scientific degree "Doctor of Sciences" in the professional field 4.2 "Chemical Sciences".

The publication activity is focused, purposeful, and closely linked to the dissertation topic, covering the synthesis, structural characterization, quantum-chemical modeling, and functional properties of selenite, selenate, and mixed-valence oxoselenate compounds. This clearly shows the conceptual unity between the dissertation and the presented scientific results.

Group G indicators include 20 scientific publications published in international peer-reviewed journals indexed in Web of Science and Scopus, distributed across quartiles Q2, Q3, and Q4. Particularly noteworthy is the fact that:

- A significant portion of the publications appear in journals of leading international publishers such as Elsevier and Springer;
- In many of them, Prof. Dr Yankova-Avramova is the lead or corresponding author, unequivocally demonstrating her independent and defining scientific contribution;
- The declared publications have not been used in other competitive procedures, ensuring their exclusive belonging to this dissertation.

The scientific content of the publications is distinguished by:

- High methodological rigor, combining X-ray structural analysis, spectroscopy, thermal analysis, and modern quantum-chemical approaches (DFT, NBO, AIM, RDG, Hirshfeld surface analysis);
- Analytical depth expressed through clear elucidation of relationships between structure, electronic organization, and functional properties;
- Originality, including publications dedicated to newly synthesized compounds, mixed-valence systems, and nanomaterials.

A key indicator of the scientific significance of the publications is the number of citations. The declared 96 citations, related solely to publications included in the dissertation, yield 192 points under Group D indicators, significantly exceeding the minimum requirements. This clearly indicates the recognition, relevance, and international impact of the scientific results.

The publication activity also shows progressive development and advancement—from classical structural and spectroscopic studies to complex interdisciplinary research, including nonlinear optical properties, thermodynamic modeling, and biological activity. This evolution is characteristic of a mature and established scientist with a clearly defined scientific school.

In summary, it can be concluded that the submitted scientific publications:

- Are of high quality, thematically unified, and scientifically significant;
- Fully meet and exceed the minimum national and institutional requirements;
- Represent a substantial and original contribution to the inorganic and structural chemistry of selenium-containing compounds.

Prof. Dr Rumyana Yankova-Avramova's publication record convincingly confirms her high scientific authority, independence, and leading role in the researched scientific field and fully supports the awarding of the scientific degree **"Doctor of Sciences"**.

6. Author's Abstract

The abstract comprises 71 pages and contains 38 figures, which clearly and accurately reflect the main results and scientific contributions of the dissertation thesis. The information presented is well-organized, precise, and provides a true representation of the aims, objectives, methodology, and achieved results of the research. The abstract fully complies with the specific requirements of Burgas State University "Prof. Dr Assen Zlatarov" and fulfils its purpose as an objective and adequate summary of the dissertation thesis.

7. Brief Notes and Recommendations

I have no critical remarks regarding the dissertation. The studies on the biological activity of the synthesized oxoselenate compounds are particularly interesting and promising. Therefore, I recommend that Prof. Yankova continues and expands this research, including a deeper mechanistic analysis and testing on additional biological models, with the aim of more fully revealing their potential for future biomedical applications.

CONCLUSION

The dissertation thesis of Prof. Dr Rumyana Zlatinova Yankova-Avramova demonstrates a high degree of scientific maturity and represents a systematic and well-argued study of contemporary issues related to the structure, properties, and functional characteristics of selenium-containing inorganic systems. The topic addressed is both timely and significant from theoretical and applied perspectives, with clearly defined research objectives that have been achieved through the targeted use of an appropriate modern methodological framework.

The work is structured in a coherent and logically justified manner, with the chosen experimental and theoretical approaches fully corresponding to the set tasks. The obtained results have been critically analyzed and interpreted with the necessary scientific rigor, and the conclusions and formulated contributions emphasize the originality of the research and its importance for the development of crystal chemistry, materials science, and related interdisciplinary fields.

Based on this analysis, I give a positive evaluation of the dissertation thesis and propose that the Scientific Jury award Prof. Dr Rumyana Zlatinova Yankova-Avramova the scientific degree of "Doctor of Sciences" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.2 Chemical Sciences, scientific specialty "Inorganic Chemistry".

06.01.2026 г. **Member of the Scientific Jury:**

Подпис заличен
чл.2 от ЗЗЛД

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