

OPINION

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Regarding a Dissertation Thesis for the Award of the Educational and Scientific Degree "Doctor" in **Scientific Field** 4. Natural Sciences, Mathematics and Informatics; **Professional Field** 4.1. Physical Sciences; **Doctoral Programme** "Electrical, Magnetic and Optical Properties of Condensed Matter".

Doctoral Candidate: Nikolay Diyanov Minev

Supervisor: Prof. Vera Marinova, D.Sc.

Dissertation Title: "Synthesis of nanolayers of 2D materials for applications in optoelectronics"

Prepared by: Member of the Scientific Jury appointed by Order No. RD-15-311/15.04.2026 of the Director of the Institute of Optical Materials and Technologies "Acad. Yordan Malinovski", Bulgarian Academy of Sciences: Assoc. Prof. Nataliya Dimitrova Berberova-Buhova, Ph.D.
Institute of Optical Materials and Technologies "Acad. Yordan Malinovski", Bulgarian Academy of Sciences

1. Brief Biographical Information about the Doctoral Candidate

Nikolay Diyanov Minev obtained a Bachelor's degree in 2018 from the Faculty of Physics at Sofia University "St. Kliment Ohridski", majoring in Theoretical Physics. In 2021, he completed a Master's degree at the same institution in Medical Physics.

In 2022, he was enrolled as a full-time doctoral student at the Institute of Optical Materials and Technologies "Acad. Yordan Malinovski", Bulgarian Academy of Sciences.

Since 2020, he has been working at the Institute of Optical Materials and Technologies, Department of Optical Materials, as a Physics Technician.

2. Description of the Dissertation Thesis

The submitted dissertation entitled "Synthesis of nanolayers of 2D materials for applications in optoelectronics" comprises 166 pages and is structured as follows: Introduction; Relevance, Objectives and Structure; five chapters (Chapter I – Literature Review); Conclusions; Main Contributions; List of Publications, Citations, Conferences and Projects; List of Tables and Figures; List of Symbols and Abbreviations; and References. The dissertation contains 55 figures and 7 tables. A total of 271 literature sources have been used and cited.

The dissertation is accompanied by a 49-page abstract that follows its structure and reproduces its content, with the exception of the literature review, the list of conference presentations, the list of projects, and the appendix.

The dissertation addresses a topical and promising research area related to the synthesis, characterization, and application of two-dimensional (2D) materials in optoelectronics. The investigations focus on transition metal dichalcogenides, which have attracted considerable scientific interest in recent years due to their unique structural, electronic, and optical properties.

The dissertation is based on a substantial amount of experimental work and is organized in a logical and coherent manner. The initial chapters provide a comprehensive review of the current state of research on two-dimensional materials, methods for their preparation, and modern characterization techniques. The analysis of the cited literature demonstrates the author's thorough knowledge of the subject matter.

The main part of the dissertation is devoted to the development and optimization of technological processes for synthesizing PtSe₂, PtTe₂, and PdSe₂ nanoscale layers by means of thermally assisted conversion and chemical vapor deposition methods. Systematic investigations have been conducted to determine the influence of technological parameters on the structure and properties of the obtained materials.

Particularly noteworthy is the use of a broad range of modern analytical techniques, including Raman spectroscopy, X-ray photoelectron spectroscopy, atomic force microscopy, transmission electron microscopy, X-ray diffraction, and ellipsometry. This has enabled comprehensive characterization of the synthesized materials and reliable interpretation of the obtained results.

3. Main Scientific Results, Contributions, and Significance of the Research

The following scientific and applied contributions may be highlighted:

- Development and optimization of technologies for obtaining nanoscale PtSe₂, PtTe₂, and PdSe₂ layers on various substrates.
- Establishment of relationships between synthesis parameters and the structural, optical, and electronic characteristics of the obtained layers.
- Detailed experimental characterization of the synthesized materials using a comprehensive set of modern analytical methods.
- Demonstration of the applicability of the obtained materials in optoelectronic devices, field-effect transistors, transparent conductive coatings, and antibacterial surfaces.
- Obtaining results with significant potential for practical application and further development in the fields of microelectronics and nanoelectronics.

The scientific results are presented accurately and convincingly. The conclusions are logically derived from the conducted experimental investigations and are supported by a sufficient amount of experimental data.

The dissertation demonstrates that the doctoral candidate possesses profound theoretical knowledge, strong experimental skills, and the ability to conduct independent scientific research. The obtained results constitute valuable contributions and are of interest both for fundamental science and for applied research in the fields of two-dimensional materials and optoelectronics.

4. Assessment of Publications and Personal Contribution of the Candidate

The research related to the dissertation has been fully or partially published in four full-text scientific papers. Eleven citations of two of the publications related to the dissertation have been identified.

Among the publications included in the dissertation, Nikolay Minev is the first author of two papers and the second author of the remaining two, which clearly indicates his substantial contribution to the conducted research.

5. Critical Remarks and Recommendations

I have no critical remarks regarding the submitted materials. Certain terminological and grammatical inaccuracies can be observed; however, they do not hinder the understanding of the presented work.

I recommend further unification of the writing style, notation, and abbreviations used, as well as adherence to the established terminology in the relevant scientific field.

6. Conclusion

The dissertation of Nikolay Minev represents a focused, well-planned, and high-quality study on the preparation of nanoscale layers of 2D materials for optoelectronic applications.

The achieved results and the manner in which they are presented in both the publications and the dissertation provide sufficient grounds for a highly positive evaluation. A substantial amount of research work has been carried out at a high scientific level, employing a wide range of modern experimental and analytical methods.

The dissertation fully satisfies the requirements for the award of the educational and scientific degree “Doctor”. Based on the established scientific and applied contributions and the significance of the obtained results, I express my positive opinion and recommend that the esteemed Scientific Jury award the educational and scientific degree “Doctor” in Professional Field 4.1. Physical Sciences to Nikolay Diyanov Minev.

Sofia
04 June 2026

/Assoc. Prof. Nataliya Berberova-Buhova, Ph.D./