# REPORT

of dissertation for the acquisition of:

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|---|---|
| educational and scientific degree " **doctor** " | X |
| scientific degree **"Doctor of Science"** | |
| | the true is indicated by the sign "X" |

**Author of the dissertation**:

| | | Venetsia | Nikolaeva | Garova | |
|---|---|---|---|---|---|
| academic position | scientific degree | name | middle name | last name | workplace |

**Topic of the dissertation**:

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|---|
| Anodic behavior of zinc |

**Scientific area**:

| 4 | Natural Sciences, Mathematics and Informatics |
|---|---|
| code | name |

**Professional area**:

| 4.1 | Physical Sciences |
|---|---|
| code | name |

**Scientific specialty**:

| |
|---|
| Structure, mechanical and thermal properties of condensed matter |

**The report was written by**:

| Prof. | PhD | Dimana | Ilieva | Nazarova | UCTM / IOMT |
|---|---|---|---|---|---|
| academic position | scientific degree | name | middle name | last name | workplace |

**1. Meeting the minimum requirements under the Regulations:**

| | | |
|---|---|---|
| A) The candidate meets the minimum requirements | 20 points | X |
| B) The candidate doesn't meet the minimum requirements | 0 points | |
| | | one of the answers given is marked with the sign "X" |

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| It is mandatory to fill in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed. |
| According to the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Acquisition of Scientific Degrees and Occupation of Academic Positions at the UCTM, the candidate Venecia Garova exceeds the minimum requirements. |

The scientific publications on the dissertation are 3 (two publications in Q2, under indicator 7 and one under indicator 8 under appendix 5a with a total number of points of 55).
4 citations have been noted on the scientific publications included in the dissertation.

## 2. The relevance of the topic of the dissertation:

| | | |
|---|---|---|
| A) The topic is relevant and new (there are no known results on the topic by other authors) | 8 points | |
| B) The topic is relevant and results from other authors are known | 6 points | X |
| C) The topic is not relevant, but results from other authors are known | 2 points | |
| D) The topic is not relevant and no results from other authors are known | 1 point | |
| E) The topic does not correspond to the level of dissertation | 0 points | |
| | | one of the answers given is marked with the sign "X" |

| The evaluation of the relevance of the dissertation must be substantiated |
|---|
| The dissertation is related to the study of the anodic behavior of zinc, the relevance of which is determined by the extensive applications, such as protective coatings, sensor applications and applications in electronics, production of nanoparticles, salts, batteries and others. The extensive review of the literature made by the PhD student convinces of the relevance and importance of the scientific research planned by him. The clearly stated goal of the dissertation and the formulated specific tasks for its achievement have allowed their successful implementation. |

## 3. Type of research:

| | | |
|---|---|---|
| A) Theoretical | 4 points | |
| B) Applied | 4 points | |
| C) Theoretical with application elements | 4 points | X |
| D) It does not correspond to the level of dissertation | 0 points | |
| | | one of the answers given is marked with the sign "X" |

| The level of research must be substantiated if answer D is marked. |
|---|
| The tasks performed and the results achieved in the dissertation are of a fundamental nature, but they also contribute to practical applications in many areas such as electronics, sensors, and others. |

## 4. Objectives of the research:

| | | |
|---|---|---|
| A) Realistic and of scientific and / or applied interest | 8 points | X |
| B) Realistic, but not of scientific and / or applied interest | 3 points | |
| C) Unattainable (unrealistic) | 0 points | |
| | | one of the answers given is marked with the sign "X" |

| Objectives must be specified. The type of the set objectives must be justified. |
|---|

The main goal of the dissertation work is to study the anodic behavior of zinc in aqueous borate electrolytes and aqueous solutions of sodium hydroxide and to characterize the resulting layers. To achieve this goal, the following main tasks have been set, such as studying the dependence of the kinetics of the anodic behavior of zinc in aqueous borate electrolytes and aqueous solutions of sodium hydroxide on various parameters. Numerous studies of the resulting layers have also been carried out using spectroscopic, microscopic and diffractometric methods. The dissolution has also been studied using optical emission spectroscopy with inductively coupled plasma.

## 5. Contributions of the dissertation:

| | | |
|---|---|---|
| A) With lasting scientific and / or applied response, they form the basis for new research and applications | 20 points | X |
| B) They are of significant scientific and / or applied interest, complete and / or summarize previous research | 16 points | |
| C) They are of scientific and / or applied interest | 12 points | |
| D) Lack of significant contributions | 8 points | |
| E) Lack of contributions | 0 points | |
| | | one of the answers given is marked with the sign "X" |

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| Contributions must be specified. The type of results achieved must be justified. |

The contributions and conclusions of this dissertation work are formulated in detail in 17 points. They relate to the study of the anodic behavior of zinc in aqueous borate electrolytes and in aqueous sodium hydroxide solutions and the characterization of the resulting layers.

In my opinion, the most significant contribution is formulated in point 7 and is expressed in the creation of a model describing the process of film growth. According to it, two processes occur during the induction period. The first of them is the dissolution of the metal surface and the formation of pittings, the number and size of which increases with time. The second process is the formation of spherical granules on the surface of the electrode, the number of which also increases, but their size does not. When the granules cover the entire surface of the metal, the distances between them are filled and a dense film is obtained. A theoretical explanation of the behavior of this layer with increasing its thickness is also given. A conclusion was also made about the influence of increasing the concentration of the forming electrolyte on the increase in the duration of the induction period, as well as the influence of the concentration of boric acid in the forming electrolyte.

## 6. Conclusion

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|---|---|---|
| A) The evaluation of the dissertation is **POSITIVE** | This evaluation is assigned to a total number of at least 40 points | X |
| B) The evaluation of the dissertation is **NEGATIVE** | This evaluation is assigned to a total number below 40 points | |
| | | one of the answers given is marked with the sign "X" |

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| To be filled in at the request of the member of the scientific jury |

The dissertation fully meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation and the Regulations for the Acquisition of Scientific Degrees and Occupation of Academic Positions at the UCTM. Therefore, I give a positive assessment of the dissertation submitted to me for an opinion and propose to the esteemed members of the Scientific Jury to award the educational and scientific degree "doctor" in the scientific field 4. Natural Sciences,

Mathematics and Informatics, professional field 4.1. Physical Sciences, scientific specialty Structure, Mechanical and Thermal Properties of Condensed Matter to Venetsia Nikolaeva Garova.

| 17.03.2025 | The report was written by:<br><br>**Prof. PhD Dimana Nazarova** | |
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| date | | signature |