

# ATTITUDE OF REVIEWER

## of a PhD thesis

**in professional field 4.1. Physical Sciences, scientific speciality – Radiophysics and Physical Electronics, by procedure for defense in Faculty of Physics, Sofia University “St. Kliment Ohridski”**

Reviewer: Dr. Krassimir Angelov Temelkov, Professor at the Georgi Nadjakov Institute of Solid State Physics, Bulgarian Academy of Sciences

(академична длъжност, научна степен, име, презиме, фамилия - месторабота)

as a member of the scientific jury according to order № РД 38-95 / 21.02.2023 г. of Rector of the Sofia University “St. Kliment Ohridski”.

**PhD thesis title: Conversion of CO<sub>2</sub> using Arc Discharges at Atmospheric Pressure**

**Author of the PhD thesis: Vladislav Valentinov Ivanov**

### **I. General description of the materials presented**

#### **1. Data for the documents presented**

The candidate Vladislav Valentinov Ivanov has presented dissertation, abstract in Bulgarian and English languages, copies of the publications included in the PhD thesis and mandatory for the Faculty of Physics, Sofia University “St. Kliment Ohridski” (FPh, SU) table with the recommended requirements and check for the lack of plagiarism (report for similarity of the dissertation text, protocol and attitude) according to the SU “St. Kliment Ohridski” Regulation for Conditions and Order for Acquiring of Scientific Degrees and Occupation of Academic Positions (RCOASDOAP). Autobiography, diplomas for Bachelor of Science (BSc) and Master of Science (MSc) degrees, request for predefense allowance and declaration for authorship are also presented. The presented materials meet the National requirements, the corresponding Regulation and the requirements recommended by the RCOASDOAP SU “St. Kliment Ohridski” for PhD degree.

#### **2. Data for the candidate**

V. Ivanov has acquired BSc and MSc degrees from FPh, SU “St. Kliment Ohridski” in scientific speciality “Communications and Physical Electronics” together with additional qualification for teacher in physics and astronomy in 2016 and 2018, respectively. From 2013 to 2014 he developed software for visualization and simulation in Software Academy “Telerik“ using C# and JavaScript. V. Ivanov has been PhD student in the Department “Radiophysics and Physical Electronics”, FPh, SU “St. Kliment Ohridski” getting involved in the study of gas discharges and plasma supervised by Associate Professor Dr. Stanimir Todorov Kolev.

#### **3. General characteristic of the scientific achievements of the candidate**

The dissertation consists of Introduction, Bibliography survey, two chapters and Conclusion. The PhD thesis is presented on 124 pages and includes 45 figures, 4 tables and bibliography of 84 references.

As a PhD student V. Ivanov has actively worked on experimental and theoretical study on low-current (30 – 200 mA) DC magnetically stabilized and gliding discharges in configuration with flat diverging electrodes at atmospheric pressure, as well as on their applicability for carbon dioxide dissociation.

Scientific publications included in the dissertation meet the minimal National requirements, the corresponding Regulation and the additional requirements recommended by the RCOASDOAP SU “St. Kliment Ohridski” for PhD degree in professional field 4.1. Physical Sciences, scientific speciality – Radiophysics and Physical Electronics.

There is no proof for plagiarism according to the law in the PhD thesis, its abstract and the publications included.

#### **4. Analysis of the scientific and applied achievements of the candidate in the competition materials submitted**

The PhD thesis have indisputable scientific and applied contributions. I would allow myself to summarize them, as follows:

1) A two-dimensional fluid model of a positive-column cross-section of an arc (or glow) discharge being non-equilibrium plasma at atmospheric pressure has been developed at consideration of the effect of an external magnetic field on the charge particles. Different stable and unstable regimes of low-current magnetically stabilized arc have been identified in a gas flow transverse to the arc current. Some of the main characteristics of a magnetically stabilized arc in a gas flow have been obtained and the effect of the gas flow and the magnetic force on the arc behavior has been investigated. This contribution is referred to the category *enrichment of existing knowledge (scientific fields, problems, theories, hypotheses) by obtaining and proving new facts through new means*.

2) An experimental setup, which consists of a high-voltage electrical power supply and a gas discharge device with flat diverging electrodes, has been developed for investigation on behaviour, properties and operational regimes of different configurations of gliding and stabilized arc (glow) discharges at atmospheric pressure. This contribution is also referred to the category *enrichment of existing knowledge (scientific fields, problems, theories, hypotheses) by obtaining and proving new facts through new means*.

3) Using the developed experimental technique, conversion and energy efficiency of the gas-discharge device have been measured for each case studied, and thus assessing applicability for the carbon dioxide dissociation. I could attribute this contribution to the category *implementation of scientific achievements in practice*.

The results presented in the dissertation have been published in 3 articles, of which 2 papers are with impact factor (IF) with total IF = 12.445, as follows: one publication in Plasma Sources Science and Technology (Q1 in Scopus and Web of Science with IF = 4.124) and one article in Journal of CO<sub>2</sub> Utilization (Q1 in Scopus and Web of Science with IF = 8.321 for 2021), and one paper in

Journal of Physics: Conference Series, which is with SJR. I must note the great prestige of the international journals testified by their high impact factor. A citation of the publication in Journal of CO2 Utilization from 2023 is found in the journal Problems of Atomic Science and Technology (Q3 in Scopus) that is demonstrative for the quality of the results obtained.

All publications are coauthored. The PhD student is the first author in all papers, which is rare occurrence and unambiguously proves that he has leading contribution.

### **5. Critical remarks and recommendation**

The PhD thesis and the abstract have been written in clear and precise language and, except for some minor exception, I do not notice substantial errors. The abstract reflects accurately the dissertation. According to me, the PhD student has mastered research material on a high level and has demonstrated very good knowledge on the types of the gas discharges mentioned and their application for the carbon dioxide dissociation. I highly appreciate the PhD student skills at the experimental and theoretical study on the gas-discharge plasma.

### **6. Personal impression of the candidate**

There is no personal impression of the candidate.

### **7. Conclusion**

After becoming acquainted with the presented dissertation, abstract and other materials and based on the made analysis of their significance and the scientific and applied achievements contained in them, I **confirm** that the scientific achievements meet the National requirements, the corresponding Regulation and the additional requirements recommended by the RCOASDOAP SU “St. Kliment Ohridski” for PhD degree. There is no proof for plagiarism according to the law in the presented PhD thesis, its abstract and the papers included.

My assessment of the dissertation is positive.

## **II. GENERAL CONCLUSIONS**

Based on the abovementioned, I recommend to the esteemed members of the scientific jury to confer the PhD degree on Vladislav Valentinov Ivanov in professional field 4.1. Physical Sciences, scientific speciality – Radiophysics and Physical Electronics.

17.05. 2023 г.

Reviewer: .....

( prof. Dr. Krassimir Angelov Temelkov )