O P I N I O N

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on the dissertation for the award of the educational and scientific degree "doctor"
in: field of higher education 5. Technical Sciences,
professional field 5.1. Mechanical Engineering,
doctoral program "Methods for controlling and testing materials, products and equipment"

Author: mag. Eng. Miroslav Dimitrov Simov
Topic: "Increasing the service life of plastic molding tools"
Scientific supervisor: Assoc. Prof. Dr. Eng. Velko Slavchev Rupetsov, Plovdiv University "Paisii Hilendarski"

1. General presentation of the procedure and the doctoral student

By order No. RD-22-1993/20.10.2025 of the Rector of Plovdiv University "Paisii Hilendarski" I am appointed as a member of the scientific jury for the procedure for the defense of a dissertation work for the acquisition of the ONS "doctor" on the topic "Methods for controlling and testing materials, products and equipment". The author of the dissertation work is M. Eng. Miroslav Dimitrov Simov, a doctoral student in full-time education at the Department of Mechanical Engineering and Transport of Plovdiv University. The procedure is in the field of higher education 5. Technical sciences, professional field 5.1 Mechanical engineering, doctoral program “Methods for controlling and testing materials, products and equipment”. The scientific supervisor is Assoc. Prof. Dr. Eng. Velko Slavchev Rupetsov from PU.

I have information about the doctoral student and the dissertation he developed from the electronic set of materials presented to me, including a dissertation, an abstract in Bulgarian and English, a list of publications, copies of publications, a certificate of compliance with the minimum requirements of the Law on the Development of the Academic Staff of PU, declarations of originality and authenticity. They comply with the requirements of Art. 36 (1) and (3) of the Regulations for the Development of the Academic Staff of PU. The dissertation of Eng. Simov is presented in a volume of 139 pages and contains an Introduction, six separate chapters, Conclusion, Contributions and a List of publications and is structured logically and correctly.

I know Eng. Simov by document. His CV shows his competence, corresponding to the topic of the dissertation.

2. Relevance of the topic

In recent years, plastic parts and assemblies have successfully replaced traditional metals in mechanical engineering. Complex spatial parts from polymer materials with additives are produced using the injection molding process, with the molds in which it is carried out playing a structurally determining role. Increasing the technical resource of injection molding tools, while maintaining the quality of castings, has a direct positive financial effect on their production. In this sense, the developed dissertation has a topical topic, and the goal set corresponds to the requirements of the modern technical level of science and technology.

3. Knowledge of the problem

With what is described in Chapter I - Literature Review, and Chapter II - Analysis of the defects of injection molds, the doctoral student demonstrates high and in-depth knowledge in the field of manufacturing plastic products with injection molding and the related practical features of injection molds. As sources of information, he used 137 publications and Internet sites - all published after 2000.

The presented material demonstrates the author's high technical competence, his ability to analyze in detail the current state of the problem and identify "bottlenecks" in plastic injection molding. The study is summarized in conclusions, from which the scientific supervisor and the doctoral student formulate the goal and objectives of the scientific research.

The doctoral student demonstrates high knowledge in the field of modern methods for surface treatment and coating application, as well as about coatings - PVD and CVD technologies, nanoindentation, atomic force microscopy and methods for assessing adhesion are at a modern level. Work with complex measuring equipment and interpretation of the results obtained is at a high level.

Mastery of simulation of casting processes using CAD/CAE design systems is convincingly demonstrated. The results of the simulation with Moldex 3D have been professionally analyzed and interpreted, and significant conclusions have been made for the optimization of the design and technology.

The overall assessment of the doctoral student's knowledge is excellent and fully complies with the requirements for acquiring the educational and scientific degree "doctor".

4. Research methodology

Chapter 3 describes 5 methodologies and measuring equipment for determining the thickness, wear and tribological characteristics of hard coatings, adhesion and wear resistance and atomic force microscopy for examining the surface of the working surfaces of the injection molds, and selecting their material and coating. Based on practical criteria, the doctoral student has chosen suitable steel and coating as the object of research. The methodologies for the experimental studies are standard and are described in detail and comprehensively. Their use is a reason to consider reliable and credible results.

5. Characteristics and evaluation of the dissertation work and contributions

The dissertation work is structured very well, written in an understandable and academic style, including properly balanced text, tables, graphs and pictures. Chapters 4 and 5 are related to the tasks set to achieve the goal of the dissertation, with the description of the experiments carried out ending with an analysis of the results and conclusions, which is an indicator of quality work.
Practical methods for restoring defective injection molds and measures for extending their working capacity are described in Chapter 6.

The formulated scientifically applied contributions, which offer original solutions to particular problems with results concerning the wear resistance of injection molds, and the applied contributions, which find specific solutions for practical applicability, are formulated correctly and sufficiently as a result of the scientific work.

6. Assessment of the publications and personal contribution of the doctoral student

There are 3 publications on the dissertation, one of which is the doctoral student's sole author, and the other two are co-authors with the supervisor. All three publications are in English, published in publications indexed in Scopus. I have not looked for citations, but I am convinced that there will be some.

The work demonstrates Eng. Simov's strong commitment to the issues of the dissertation, his high scientific and practical competence and ability to easily handle specific terminology in the field of tool manufacturing, materials science, tribology and modern surface treatment technologies. Knowing the supervisor, I am convinced that the developed dissertation is the personal work of the doctoral student.

7. Abstract

The abstract is 32 pages long, includes the main developments of the dissertation and complies with the requirements of Art. 36, para. 1 of the Regulations for the Development of the Academic Staff of the University of Plovdiv.

8. Recommendations for future use of the dissertation contributions and results

The dissertation work is related to the practice of producing plastic injection molding. In every field of mechanical engineering there is a wide variety of forming machines, apparatuses, and other equipment, complex plastic assemblies and details, which is a prerequisite for multiplying the results of the dissertation work of Eng. Simov and their development and improvement with other materials and coatings of their injection molds besides Stavax ESR steel and the hard coating Ti/TiN/TiCN.

In general, the dissertation does not contain any erroneous statements, the methods and calculations used are standard and the results are not subject to verification.

As remarks that do not belittle the work, the following can be mentioned:

1. The literature review contains figures with text in English;

2. The conclusions do not contain any cited results for the quantitative dimensions of the increased resource (regardless of the described result for increasing the number of production cycles from 300,000 to over 1,000,000) and the wear resistance of the coating.

CONCLUSION

The doctoral student Eng. Miroslav Simov has carried out significant experimental work in terms of quantity and quality. The dissertation contains sufficient scientifically applied and applied contributions and meets the requirements of the ZRASRB, the Regulations for its implementation and the Regulations for the development of the academic staff of the University of Sofia. Based on the described and the publications, I give a positive assessment of the developed dissertation and propose to the esteemed jury to award Mag. Eng. Miroslav Dimitrov Simov, after a successful defense, the educational and scientific degree of "doctor" in the scientific field: 5. Technical sciences, professional field: 5.1. Mechanical engineering, doctoral program: Methods for controlling and testing materials, products and equipment.

28.11.2025 Prepared the opinion:

/Assoc. Prof. Dr. Eng. Ventsislav Nenov/