STATEMENT

on the dissertation thesis
for the acquisition of the educational and scientific degree Doctor in

Field of Higher Education – 5. Technical Sciences

Professional Field – 5.6. Materials and Material Science

Doctoral Program – Scientific Specialty: Materials Science and Technology of Engineering Materials

Author of the dissertation thesis: Eng. Simeon Tsankov Tsenkulovski **Title of the dissertation thesis:** Peculiarities of laser marking of layer-reinforced composites on a polymer basis

Member of the Scientific Jury: Assoc. Prof. Tatyana Mitkova Mechkarova, PhD

1. Subject and Relevance of the Dissertation Thesis

The development of new and more efficient methods for laser marking of industrial products is of particular importance, as it informs the consumer regarding composition, purpose, price, instructions for use, production date, barcode, serial number, identification symbols, corporate trademarks, logos, etc. In this way, it ensures awareness, control, traceability, and protection. Among the different materials suitable for laser marking, layered polymer-matrix composites pose the greatest challenges in terms of selecting a processing regime that ensures satisfactory quality and durability.

The literature review demonstrates the doctoral candidate's thorough knowledge of the state of the art. A total of 186 references are cited, most of which are indexed in impact factor journals or ranked databases. The data presented in the reviewed sources clearly confirm the high relevance and significance of the chosen research topic.

2. Research Methodology

The dissertation is logically structured into five chapters. Chapter 1 presents a literature review; Chapter 2 describes the equipment, materials, and methodologies; Chapters 3 and 4 are devoted to laboratory investigations; and Chapter 5 deals with mathematical modeling and optimization.

The literature review is extensive and sufficiently comprehensive to elucidate the issues related to the research problem. The methodologies proposed in Chapter 2 are thoroughly explained and accompanied by illustrative graphical representations, clarifying their role in achieving the set aims and objectives. Chapter 2 also presents the design and development of an innovative laser system for marking layered polymer-matrix composites, which serves as the basis for the experimental and scientific investigations in Chapters 3 and 4. The final chapter offers a research-based approach to the mathematical analysis of the obtained results and provides optimization solutions to the studied problems.

The aim and objectives of the dissertation are clearly formulated and fully address the scope of the research. The experimental investigations are competently conducted and correspond to the planned aims and objectives of the thesis.

3. Contributions of the Dissertation Thesis

Scientific and Applied Contributions

A conceptual model for the design of a laser system for marking layered polymer-matrix composites (Chapter 2).

Mathematical models describing the influence of laser beam power and marking speed on penetration depth and marking width during laser marking of textolite and glass-textolite (Chapter 5).

Identification of the response of two materials (textolite and glass-textolite) with respect to the characteristics of the marking trace, induced by the process parameters of laser marking (Chapters 3 and 4).

Applied Contributions

A functional laser system for marking layered polymer-matrix composites (Chapter 2).

4. Publications and Citations Related to the Dissertation Thesis

The doctoral candidate has eight publications directly related to the dissertation topic and an additional two addressing research methodologies. One of the publications is single-authored, while the others are co-authored with established researchers, which testifies to the broad scope of the candidate's scientific work.

Upon verification, I conclude that the doctoral candidate fully meets the national requirements in terms of categories and indicators.

5. Authorship of the Obtained Results

In five out of the eight dissertation-related publications, the candidate is the first author. In addition, he has contributed to two utility models and two patents, which further confirms his independence in research and authorship of the obtained results.

6. Comments, Recommendations, and Remarks on the Dissertation Thesis

The dissertation sufficiently clarifies the research problem. Therefore, I have no questions or critical remarks.

7. Conclusion

The presented work possesses the scope and quality required of a dissertation thesis for awarding the educational and scientific degree Doctor. It complies with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and its implementing regulations.

I give a positive evaluation of the dissertation thesis and recommend that the esteemed scientific jury award Eng. Simeon Tsankov Tsenkulovski the educational and scientific degree Doctor in the Field of Higher Education 5. Technical Sciences, Professional Field 5.6. Materials and Material Science, Scientific Specialty: Materials Science and Technology of Engineering Materials.

Date: 01.09.2025

Signature: ……

/Assoc. Prof. Tatyana Mechkarova, PhD/