

OPINION

by Assoc. Prof. Eng. Krastin Krasimirov Yordanov, Ph.D

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of a dissertation for the acquisition of an educational and scientific degree „**Doctor**“

Topic: „**EFFICIENCY OF THE COMBUSTION PROCESS WHEN
BURNING PELLETS AND WASTE RAW MATERIALS IN BOILERS**“

Author: Eng. Nevena Milcheva Mileva

Scientific field: 5. Technical sciences

Professional field: 5.4. Energetics

Doctoral program: Thermal engineering

1. Relevance of the problem developed in the dissertation

The dissertation consists of 178 pages, including 84 figures, 36 tables, and 2 appendices, organized into 6 chapters, general conclusions, and a list of references comprising 141 titles, of which 36 are in Cyrillic, 97 in Latin, and 8 are online sources.

The primary goal of this dissertation is to improve the efficiency of the combustion process when burning pellets and waste materials in boilers. This has been achieved through an analysis of the combustion characteristics of the materials used, optimization of combustion parameters, development of technologies to enhance the efficiency of installations, and reduction of their negative impact on the environment.

As the global population continues to grow, environmental pollution and the depletion of natural resources pose significant threats to the sustainable development of modern society. Effectively addressing these challenges requires both responsible resource management and advancements in technologies that utilize renewable energy. By reducing dependence on fossil fuels and mitigating environmental damage, these innovations contribute to balancing economic growth with environmental preservation, paving the way for a more sustainable future.

As a resource of increasing popularity, biomass plays a significant role in this process. Its combustion in various forms is a complex process influenced by multiple factors, whose thorough study and optimization are essential. For this reason, I consider the dissertation

topic particularly relevant, and the applications of the studied technologies and methods can contribute to improving energy efficiency, reducing harmful emissions, and ensuring the sustainable use of renewable energy sources.

2. Main contributions

The contributions are categorized into three main groups: scientific-applied, applied, and methodological.

The scientific-applied contributions encompass the study of the properties of pellets of various origins using different thermal methods, as well as their classification into groups based on their intended use. Mathematical models have been developed for analyzing combustion processes in solid fuel combustion, aiding in the optimization of operating conditions. Additionally, a cogeneration system based on the Organic Rankine Cycle, utilizing waste solid fuel (wood waste), has been developed and analyzed. This system can operate with high efficiency if a suitable application for the generated low-temperature thermal energy is identified.

The applied contributions include the identification of the need for pre-treatment of wood pellets to improve their characteristics for household applications. A model for automated fuel and air supply regulation in the combustion process has been developed, leading to increased efficiency and reduced operational costs.

The methodological contributions involve the development of a universal methodology that integrates experimental research, thermal analyses, and numerical simulations. This methodology allows for adaptation to various fuel types and combustion systems. Additionally, simulation models have been developed for monitoring and predicting combustion efficiency and emissions, ensuring compliance with environmental standards and alignment with technological parameters.

3. Critical remarks on the work presented

The dissertation demonstrates that the author is a highly competent specialist and researcher, capable of independently addressing complex scientific problems. My recommendation is that Nevena Mileva continue her research in the chosen field, further developing and applying the results in scientific projects. The candidate's works are written in a clear scientific language and exhibit a high level of competence. I recommend that she

focus her efforts on publishing in impact-factor journals and actively participating in research teams.

4. Conclusion

Based on the above, I assess the presented dissertation as original and complete in relation to the defined scientific objective and its associated tasks. I give a positive evaluation of the contributions formulated in the work. I believe that the dissertation work fully complies with the ZARAS in the Republic of Bulgaria and the Regulations for its implementation. This gives me the reason to propose to the respected scientific jury to award M.Eng. Nevena Milcheva Mileva the educational and scientific degree of Doctor in the field of higher education 5.Technical sciences, Professional field 5.4.Energetics, Doctoral program: Thermal Engineering.

24.02.2025

Varna

Member of the scientific jury:

/Assoc. Prof. Eng. Krastin Yordanov, Ph.D/