DISSERTATION OPINION

by Prof. DSc Dimitar Andonov Dichev on the dissertation work of Assoc. Prof. Tsanka Dimitrova Dikova, titled ***Properties of additively manufactured dental materials*** for awarding the scientific degree of Doctor of Science in professional field *5.6 Materials and Material Science* and scientific subject *Material Science and Technology of Machine Building Materials*,

1. Topicality of the problem studied in the dissertation work

Today digitalization is considered a key factor for the advancement of industrial and engineering processes. That new world of connectivity and digitalization requires new engineering and technological solutions for the new reality in all areas of human life. Up-to-date CAD/CAM/CAE design tools offer new integrated solutions for analysis, modeling and simulation thus expanding the range of application of the new digital technologies in a number of labour-intensive manufacturing areas. Furthermore, those technologies provide possibilities for thoroughly investigating the properties of processes and objects, which appears a prerequisite for achieving optimal solutions at design and validation stages. Over the last years this hi-tech segment of mechanical engineering has considerably influenced a number of other areas of human life, e.g. the area of implantology.

The methods and tools for integrating digital technology into the manufacturing techniques using addition of materials in the dentistry sector could be considered in that context. The aim of the present work is exactly the search for new more effective methods ensuring the application of some layered dental materials supporting the development of technological processes for the production of high quality temporary and permanent fixed prosthetics.

The above mentioned defines the subject of the dissertation work as topical, timely and significant, looking for new application models in theoretical and practical aspects in modern science and practice.

2. Research methods

The present work aims to investigate the properties of layered dental materials and to identify the conditions for their application in dentistry.

To achieve the above aim, the author has chosen an approach which involves theoretical and experimental investigation where the methods for solving the problem in view are as follows: theoretical analysis, experimental tests of geometrical accuracy, roughness, density, microstructure, chemical composition, hardness and toughness, as well as statistical processing of the results obtained. The calculation algorithms are based on the 3D models of the typical specimen making possible the numerical analysis of the solutions by using the Finite Element Method. Some problems are solved in a theoretical way and the others by experimental test methods which have been precisely developed for the purpose of the dissertation.

The methods been chosen completely correspond to the conceptual framework of the dissertation work. The scope of research suggests the application of a sophisticated set of research approaches, technologies and relevant tools. The aim been chosen, the tasks been defined and the hypotheses been formulated refer to the entire cause-effect process built in quest of introducing the results into practice.

3. Scientific contributions of the dissertation work

The contributions of the dissertation work are defined by the successfully solved problems, which have been set in advance. I accept the submitted reference for scientific and applied scientific contributions but I have the following observations:

- I think that the research methods and tool been developed should not be included as a scientific contribution. Therefore I suggest that contribution 1.3 should be included in the applied scientific contributions;
- I believe that it is better to include contribution 1.6 in the applied contributions because it claims the improvement of manufacturing technologies.

4. Publications and citations of publications in relation to the dissertation work

The main considerations in the dissertation work are based on 24 publications, one of which is part of a book published abroad. The above publications were published within the period 2014 – 2019, nine of which in refereed and indexed journals from Web of Science or/and Scopus databases. Two of the publications have an Impact Factor (WoS). With five of the publications assoc. prof. Dikova is the single author and the rest are written in collaboration with other authors, where the number of co-authors varies

from 2 to 6. She is the lead author of 17 of those publications, and the second co-author of other 6 publications.

Therefore, I assume that assoc. prof. Dikova has the greatest contribution to the above publications, which means that the formulation of problems, the organization and conduction of the respective experiments, the data analysis and publication of results are her outstanding achievement.

The databases I have consulted clearly show that assoc. prof. Dikova's publications have been noticed by the scientific society. To confirm the above mentioned, I would like to highlight the fact that there are 12 citations of author's publications in world-known databases.

5. Authorship of the results obtained

In my opinion, the thesis is a complete scientific work. I am highly impressed by the fact that the main conclusions are synthesized on the basis of extensive test material. Most of the results achieved have been published in prestigious international journals and, as I have already mentioned, assoc. prof. Dikova plays a leading role in all of them. Therefore, I believe the authorship of the results obtained is her outstanding achievement.

6. Observations

The above presented strengths of the dissertation work explicitly dominate in my overall opinion about it. However, I would allow myself to come up with the following observation:

The basic quantities by means of which the geometrical accuracy is quantitatively investigated are *error* and *uncertainty*. Those two quantities possess their own characteristics that affect the results of each experimental test. Unfortunately, there is not any convincing evidence for their correct interpretation in the dissertation work.

7. Conclusion

In my opinion, the thesis is a complete scientific work including summaries and solutions which contribute to science in their significance and originality. The content is well-structured and clearly presented.

To sum up, the dissertation work fully complies with the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its

application, in particular its part “Doctor of Science”. With regard to the above mentioned, I would like to propose to the honorable Scientific Jury to award the scientific degree of “Doctor of Science” to assoc. prof. Tsanka Dimitrova Dikova in professional field *5.6. Materials and Material Science* and scientific subject *Material Science and Technology of Machine Building Materials.*

07. 06. 2019 Written by:……/signature……..

/prof. DSc Dimitar Dichev/