

Dr. prof. Rimvydas Milašius
Professor at Department of Production Engineering,
Faculty of Mechanical Engineering and Design,
Kaunas University of Technology,
Kaunas, Lithuania

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Review report on Doctoral Dissertation

of Bethalihem Samuel

**entitled „ACOUSTIC PROPERTIES OF WEAVE STRUCTURE DEPENDING ON THEIR INTERNAL
GEOMETRY“**

(scientific supervisor Prof. Dr. Hab.Eng. Marcin Barburski)

prepared based on the invitation in accordance with Resolution no. 48/6/IİK/2023 of the Council for Academic Degrees dated June 6, 2023

The review was performed on the basis of the Doctoral Dissertation in English. The doctoral dissertation consists of an introduction and six chapters, including literature review (22 pages), three chapters of results with materials and methods description and results and discussions presentation (total 80 pages), chapter of summary and recommendation (4 pages), 4 conclusion and list of 106 references. Also the list of published papers and conferences is presented. Author presented 5 papers in journals cited in Web of Science database, 4 of them are published and 1 submitted, in 4 of them author is the first co-author of paper. The investigations also were presented in 3 conferences in Poland and Croatia. The doctoral dissertation contains 123 pages, 49 figures, and 9 tables.

The first chapter “Introduction” presents the research problem, the aim and objectives of the dissertation, justification of the choice of the research study, hypothesis, and description of the structure of the dissertation. However, in my opinion a first objective to produce woven fabrics is not a research objective. Herewith, the primary hypothesis presented not very well as the fact that fabrics increases the level of sound absorption is very well known from many previous investigations and published papers. However, the secondary hypothesis very well explain in two sentences what is novelty in this work and more detailed presented in 1.3 subchapter Significance of the Study. Summarizing above statements I can confirm that the work presented with well described novelty and significance.

The second chapter “Literature Review” presents an overview of the current state of the problem and a review of the scientific literature. Majority of presented 106 references are research papers in WoS journals of the last 10 years. Literature review presented all problems investigated in present work.

In the third, fourth and fifth chapters, the raw materials and methods of investigations used for the study are presented together with parts of results and discussions. In my opinion it is better than to present materials and methods separately in a special chapter as present style gives for reader

better understanding of work. In the third chapter author analysed the results of fabric sound reduction obtained from an anechoic acoustic chamber and the relationship between sound reduction and other properties and structure of woven fabrics and yarns. In the fourth chapter, a verification of the acoustic absorption performance of fabric as well as the results of the investigation of nonwoven fabric and an air gap combined with woven fabrics of varying layers are presented. In the fifth chapter the optimization of woven fabrics by combining different weave structures and the influence of woven fabric layout in relation to the air gap and the layout of the nonwoven in the sample are presented and discussed. The discussions and presentations of results presented well and in very continuously style what gives for dissertation a good view as of fully finished work with explanation of every step of investigations and explanation of reasons why these investigations was carried out.

So, the dissertation fully corresponds to the problems of the field of materials engineering, it is finished scientific work presenting original results, it has clear and logic description and meets requirements of doctoral dissertations. Conclusions based on the research results. Results of research published in four articles in scientific journals with IF from the list of CA WoS and in three international conferences. However, I have some questions and remarks:

1. Description of yarns structure not fully corresponds to English description – spun yarns need be used instead staple yarns and what kind of twisted yarns were used – it was textured yarns or multifilament not textured yarns? (page 30);
2. Description of weaves also not fully corresponds to English. Presented in Figure 7 (page 30) rib weave in English need be named as rib in warps 4/4, sateen - as 5 healds sateen with possible explanation 1/4 with step 2;
3. The presentation of weaving process in page 31-32 is surplus as it is classical weaving;
4. It is not clear why sets of fabrics for different kinds of weaves were not fully the same (see Table 2 in page 33). It could give some problems for weave influence evaluation;
5. Empirical results presented without statistical analysis. It is not clear how many tests were done for average values calculation and what variance of tests. Without statistical analysis, it is impossible to evaluate reliability of tests and, for example, in some cases of air permeability results could be in the limits of error. At least coefficient of variation should be calculate. Only in chapter 4 statistical analysis calculated by ANOVA is presented and discussed;
6. In Figure 39 the scale is not presented;
7. Air permeability of all samples tested at 100 Pa pressure, however, the results in Table 9 shows that the values of multilayers materials are very low. Why for multilayer materials was not used 200 Pa pressure, which in standard recommended for technical textile?

Conclusion: The presented dissertation makes a significant contribution to the development of the scientific discipline of materials engineering at the same time, fulfils all formal requirements set forth in Article 187 of the Law on Higher Education and Science dated July 20, 2018, and conforms to principles and requests to the structure of scientific research for the degree of doctor. In my opinion, the Dissertation submitted by Bethalihem Samuel is ready to be defended orally in front of the respective committee. Therefore, I recommend the Dissertation for the next procedure at the Lodz University of Technology. In case of positive results of the defence of the Dissertation, I recommend awarding Bethalihem Samuel the title of Ph.D.



Prof. Rimvydas Milašius