Review of dissertation

Title: Advanced fibrous materials for acoustic performance
Author: Tao Yang, M.Eng.
Reviewer: Prof. Ing. Karel Adámek, CSc.

Presented dissertation summarizes the research of acoustic properties of perpendicularly-laid nonwovens. Next material features were tested, too, primarily the thermal and airflow resistivities, compressibility etc., to define their relation to the main topic of the work – the acoustic absorption of tested materials.

Research of mentioned features is important for noise damping in many areas of engineering, first of all in building and automotive fields, to supress disagreeable and harmful noise effects on human life.

The used methods of the solutions, described in thesis, are right and useful. The main objective - to examine, evaluate and discuss multi-functional properties of high-loft perpendicularly-laid nonwoven fabrics - is fulfilled. Observed various properties depend on individual structural layout of layers / fibres in tested fabric, therefore 15 different samples were used for investigations.

Received results, i.e. tested feature as function of used samples, are shortly summarized in the last chapter. After my opinion, it should be added some more discussion, for instance why the tested feature is high or low, which sample should be selected for continuation or how to change / improve the (optimal) sample.

It's a pity that author does not mention that air flow permeability and air flow resistivity are simply reciprocal values. Together with water vapor resistivity (not the objective of thesis) it could be used one parameter, only, for all. For instance the Fig. 2.20 presents results of different methods, differing in the large range of 1:5 approx. – why, what method is the best or the right? Value of $R^2 = 0{,}073$ on the Fig. 4.6 is very low, it means that tested correlation is practically none. It is clear that two groups were mixed here together (thickness range of 10-14 mm and of 16-28 mm).

The work is well-arranged in general, individual material features are explored and explained step by step.
As to publications, their number and orientations corresponds to objective of presented thesis. Author mentions 107 references, 11 publications as co-author, 9 of them are impacted and more 5 chapters in books.

I can state that presented thesis confirm the author's competences in the area of textile technics and material engineering and I recommend, in the case of successful dissertation defence,

to grant him the university degree PhD.

Liberec, 20.03.2019

Karel Adámek

Ph.D. Thesis Review

Advanced Fibrous Materials for Acoustic Performance

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The thesis is divided into five chapters with an abstract at the beginning.

Chapter 1: Introduction - in this chapter author describes the main goals of the thesis and all the research objectives are presented and described in detail. Author also briefly describes other chapters of the thesis in this section

Chapter 2: State of the Art in Literature - this chapter provides theoretical background and also explains mechanisms and describes materials used later in the thesis. Author provides us with the definition of sound absorption mechanism, sound absorption materials and also describes in detail parameters of fibrous materials such as fiber size, structural parameters, airflow resistivity, thermal properties, air permeability, etc. Author also reviews previous works written about the same or related topic.

Chapter 3: Experimental part - in this chapter author uses theory described in previous chapter and provides us with results of measurements. At the beginning of this chapter, there is a table with all the materials used later, schematics of measurement environment and photos of devices. Author describes every measurement well.

Chapter 4: Results and Discussion - in fourth and longest chapter author reviews his results and conclusions. Author compares all the results with calculated numerical values and also compares different materials with each other. All the results are well documented and all the parameters of fibrous materials and their sound absorption properties are described correctly.

Chapter 5: Conclusions - in last chapter author summarizes results of the thesis and proposes ways how to use results of this thesis in future work. This chapter also contains references in books, journal publications and conference entries.

Benefits of the thesis

1. Author performed necessary experiments and found connections between observed values and sound absorption. Author used available measurement devices and software. Gained amount of values is big and can be used in further research.
2. Author summed up available models, applied data on them and compared gained values with experiment. He reach the result he critically evaluated.
3. Author used defined materials which can be used in further application.
4. Results of the thesis are supported by current academic research and mathematical procedures are commented and it is possible to verify them. I consider results to be correct and critically evaluated.

Shortcomings of the thesis

1. Author used only results of the measurement in impedance tube and did not consider the relationship between observed models and sound absorption in omnidirectional impact of sound waves.
2. Author used correlation analysis, but did not commented its impact (coefficients of equations y, b). It is then unclear why was this analysis performed so thoroughly. Observed dependencies are just stated.

Final comments

Submitted dissertation work did reach its goals. Author showed abilities of independent research and ability to work with advanced experimental resources and software. I did not find significant shortcomings and

I recommend this Ph.D. thesis to be defended.

Questions

1. Do you consider the results of dependencies to be valid also for sound absorption in omnidirectional impact of sound waves?
2. What statistical model do experimentally researched data of sound absorption have?

In Liberec on May 13, 2019

prof. Dr. Ing. Pavel Němeček