ON SOUND ABSORPTION AND THERMAL PROPERTIES OF NON-WOVENS

by

Jin-Jing CHEN[a b*], Hong-Qin YU[a,b], Zheng GUO[a,b], Jin-Zhang YOU[c], and Wen-Fang SONG[d]

[a] College of Textiles, Zhongyuan University of Technology, Zhengzhou, China
[b] Henan Key Laboratory of Functional Textiles Material, Zhengzhou, China
[c] 3M China Limited, Shanghai, China
[d] Laboratory for Clothing Physiology and Ergonomics, the National for Modern Silk, Soochow University, Suzhou, China

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Non-woven is widely used as auxiliary materials of automobile industry due to its excellent sound absorption capability and good thermal property. The paper concludes that its density greatly affects sound absorption and thermal resistance, and an aluminum evaporated film can enhance the thermal resistance.

Key words: *non-woven, thickness, weight, sound absorption, thermal insulation property*

Introduction

With rapid development of auto industry, it brought huge market to industrial textiles, while industrial non-wovens have limitless potential as emerging materials [1, 2]. The non-wovens for automobile noise reduction have additional advantages in lightweight, environmental protection, and heat insulation. The sound absorption and thermal property of non--wovens are two main properties which will be studied herein. Different types of non-wovens will be chosen in our experiment.

Experimental details

The non-woven materials consist of polypropylene/polyolefin fiber and polyester fiber. In our work, two groups of non-wovens were chosen to study their sound absorption, see tab. 1, where the samples in group 3 and group 4 were used for study of thermal insulation.

In our present work, the absorption coefficient for non-woven was measured in the frequency ranging from 100 Hz to 10000 Hz. Generally materials with the sound absorption coefficient of bigger than 0.2 are named as sound absorption materials. Figure 1 shows that the density of non-wovens greatly affects absorption, while the thickness of non-wovens has almost no effect on absorption.

* Corresponding author; e-mail: jinjing_8327@163.com

Table 1. The components and basic parameters of 4 group samples of non-wovens

	Sample	Thickness [mm]	Weight [gm^{-2}]	Material components
Group 1	1	10	150	Polyolefin and polyester fibers
	2	10	200	Polyolefin and polyester fibers
Group 2	3	26	400	Polypropylene and polyester fibers
	4	23	400	Polypropylene and polyester fibers
Group 3	5	10	200	Polypropylene and polyester fiber
	6	18	300	Polypropylene and polyester fiber
	7	23	400	Polypropylene and polyester fiber
Group 4	5’	10	240	5 + Al evaporated film
	6’	18	340	6 + Al evaporated film
	7’	23	440	7 + Al evaporated film

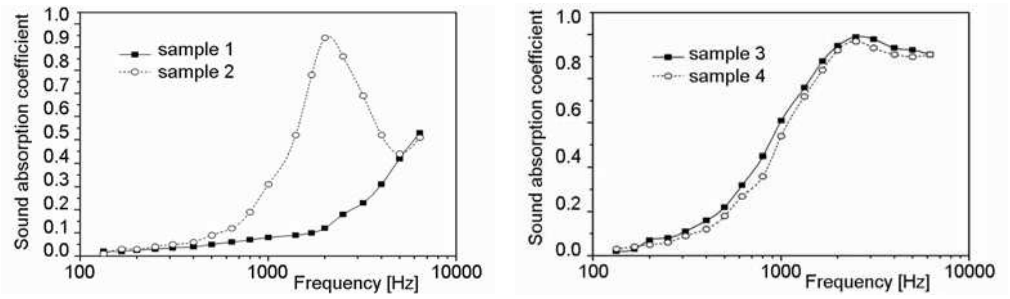

Figure 1. The sound absorption of samples 1 and 2

Figure 2 reveals the thermal properties of group 3 and group 4. It is obvious that thickness and density of non-wovens does not affect thermal conductivity very much, see fig. 2(a), while the thermal resistance increases greatly when the density rises from 200 g/m^2 to 400 g/m^2. In sample 4, an aluminum film is added, it is obvious that thermal conductivity increases greatly, while the thermal resistance enhances as well. The phenomenon will be studied theoretically in future.

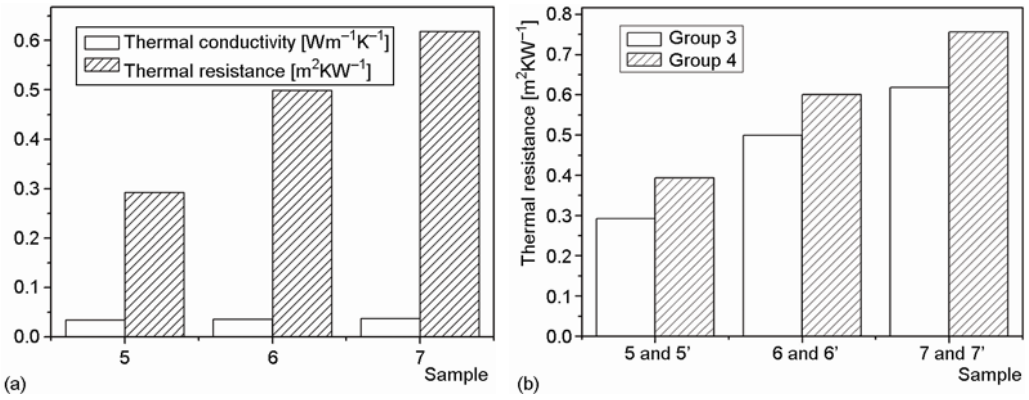

Figure 2. The thermal properties of group 3 and group 4

Conclusion

The density and thickness of non-wovens have great impacts on their sound absorbing qualities, and an aluminum evaporated film can greatly enhance the thermal resistance. The paper concludes that the new non-woven material with an aluminum film is the best candidate for noise reduce and thermal resistance.

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References

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