# SOUND ABSORPTION CHARACTERISTICS OF MULTIPLE LAYERS OF NANOFIBER AND MELT-BLOWN WEBS

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Sound proofing technologies are getting more attention to the environmental application as well as safety measure. Among various new materials, textile sound absorbents including nanofibers and melt-blown microfibers are very strong candidate for this application, and are getting more and more popular on the comercial market as noise reduction material. In this study, sound absorption characteristics of these new textile materials are analyzed by investigating the acoustic characteristics of nanofibers, melt-blown microfibers, and their webs. Impedance tube method is utilized to measure the sound absorption coefficients of mono and multiple layers of the webs and compared those with melt-blown microfiber materials in the function of fabric aerial weight. The test results showed that the sound absorption coefficients of nanofiber layers were superior that of microfiber fabrics in the frequency range below 1000 Hz. However, hybrid composition with nanofiber layer and micro fiber layer shows detrimental effect, thus lowering of absorption coefficient, especially in the 2000~4000 Hz region. Also, the sound absorption of nanofiber webs improved with numbers of layers.

**Key Words:** Sound Absorption, Nanofiber, Melt-blown Web, Microfiber

## 1. INTRODUCTION

It is very important to identify and analyze the physical mechanisms which are related to the generation, transmission and absorption of sound wave in order to find the possible ways of noise reduction. This noise reduction can be achieved by passive or active methods. Active methods such as noise cancelling etc. utilize the external energy against noise sound waves. On the other hand, passive methods are using the various absorbing materials and sound barriers. In general, the sound absorption efficiency is described as the ratio of sound energy absorbed to the sound energy incident.

Many new and light weight fiber materials for sound absorbing purpose have been introduced in recent decades. Among those materials, nonwoven fabrics are widely utilized in noise reduction or sound absorption because of their construction structure and high porosity. The acoustic properties related to sound absorption and transmission are closely related to the interaction of sound wave with the fibers in the nonwoven fabrics. Therefore, the acoustic behavior of fibrous materials has been investigated in various aspects such as fiber fineness, web porosity, web tortuosity, fiber surface area, web density, web thickness, fiber polymer, and fiber cross section etc. [1]

The characteristic properties of fiber materials have been fundamentally attributed to the very high surface area. Therefore, the sound absorbing nonwovens have been further evolved from microfibers to melt-blown web to electrospun nanofiber web. The diameter of melt-blown web has micrometer scale to sub-micrometer scale and the electrospinning provides fibers in nanometer scale. Special characteristics of these nanofibers such as high specific surface area, small fiber diameter, and high porosity allow rapid interaction of materials with surrounding air and sound waves. [2]

The main objective of this work is to investigate the usability of polyurethane nanofiber web and polypropylene melt-blown web as sound insulation materials over a wide band of frequencies. Hybrid samples consisting of melt-blown webs with different numbers of nanofiber webs were prepared and their acoustic properties were investigated.

## 2. RESULTS and DISCUSSION

The sound absorption characteristics of hybrid webs are investigated by the sound absorption coefficients. Impedance tube method is utilized to measure the sound absorption coefficients and those coefficients for mono and multiple layers of nanofibers, melt-blown microfibers, and their hybrid webs are compared in the function of fabric aerial weight. The test results showed that the sound absorption coefficients of nanofiber layers were superior that of microfiber fabrics in the frequency range below 1000 Hz. However, hybrid composition with nanofiber layer and micro fiber layer shows detrimental effect, thus lowering of absorption coefficient, especially in the 2000~4000 Hz region. Also, the sound absorption of nanofiber webs improved with numbers of layers.

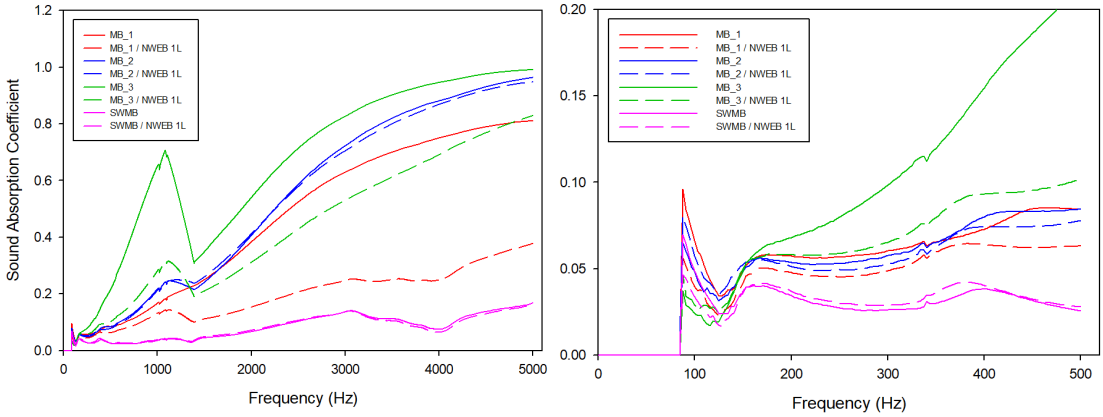


**Figure 1.** Sound absorption coefficient of hybrid webs with melt-blown webs and nanofiber webs

## 3. REFERENCES

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