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Sound Absorbing Properties of Some Auto Text Materials

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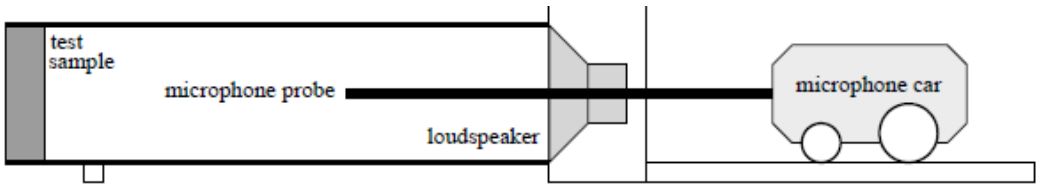
Abstract

A study of sound absorption coefficient of some auto text materials is on hand. We designed a machine with ASTM / ISO standards at NITRA.

Key Words: Sound Absorption Coefficient, Auto Textile materials.

Introduction

Bruel and Kjaer designed an apparatus for measurement of acoustic impedance in the materials which are used in designing of recording studio, automobiles interior, Theatre etc. Its growth and decay time depends on absorbing properties of materials [1]. In B&K apparatus an Impedance Tube is having absorbing material on one end and microphone car on the other end.



A loudspeaker produces an acoustic wave which travels down the pipe and reflects from the test sample. The phase interference between the waves in the pipe which are incident upon and reflected from the test sample will result in the formation of a standing wave pattern in the pipe. There is another way to calculate the absorption coefficient in which the material of unit square area is kept in the specially designed room and the RT (Reverberation time is very important property of a room for the architects and musicians.) is calculated in the presence of material and in its absence. The ratio of two is calculated at various frequencies to calculate the value of absorption coefficient. But this method is quiet lengthy and expensive.

Standing wave ratio SWR

$$SWR = \left[\frac{A + B}{A - B}\right]$$

This provides the reflection coefficient *B/A* and the sound power reflection coefficient R_{Π}. Absorption coefficient α for the test sample at a given frequency is given by

$$\alpha = 1 - R_{\Pi}^2 = 1 - \left(\frac{SWR - 1}{SWR + 1}\right)^2 = \frac{4}{SWR + \frac{1}{SWR} + 2}$$

As was the case for the impedance, the absorption coefficient may be a function of frequency, and measurements over the frequency range of interest may be required.

Apparatus:

At NITRA we designed the Impedance Tube of Steel which have diameter 235mm and its length is 1200mm. The instrument is designed under the standard and norms of ASTM and MS-300 material specification [2-9]. Sample of non-woven material with thickness 3.68mm and 1.30mm are tested on the machine. The machine is able to test the material in range of 0-799Hz range. We had tested the samples in the frequency range of 200Hz,400Hz & 600Hz the results are shown in the graph.

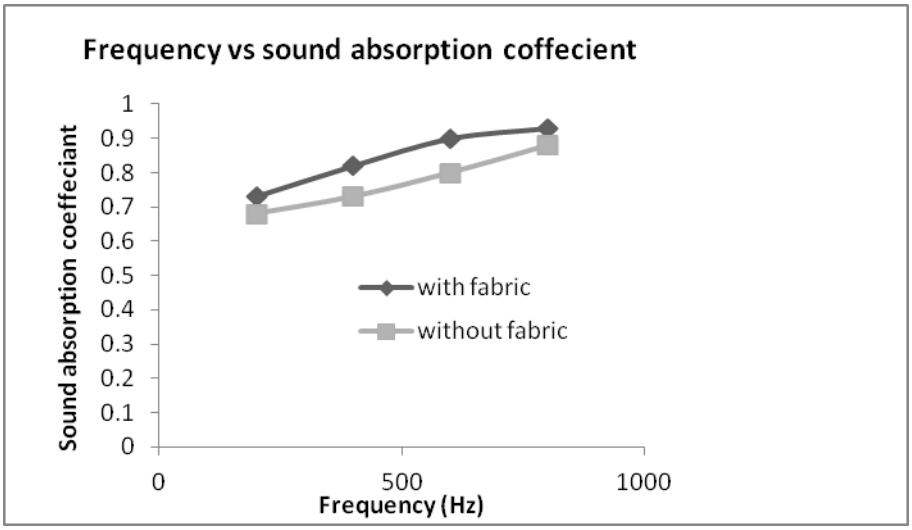


Figure1: Frequency vs absorption coefficient for 1.3mm thickness.

Another graph for the sample of 3.68mm thickness is shown below for the same frequency range.

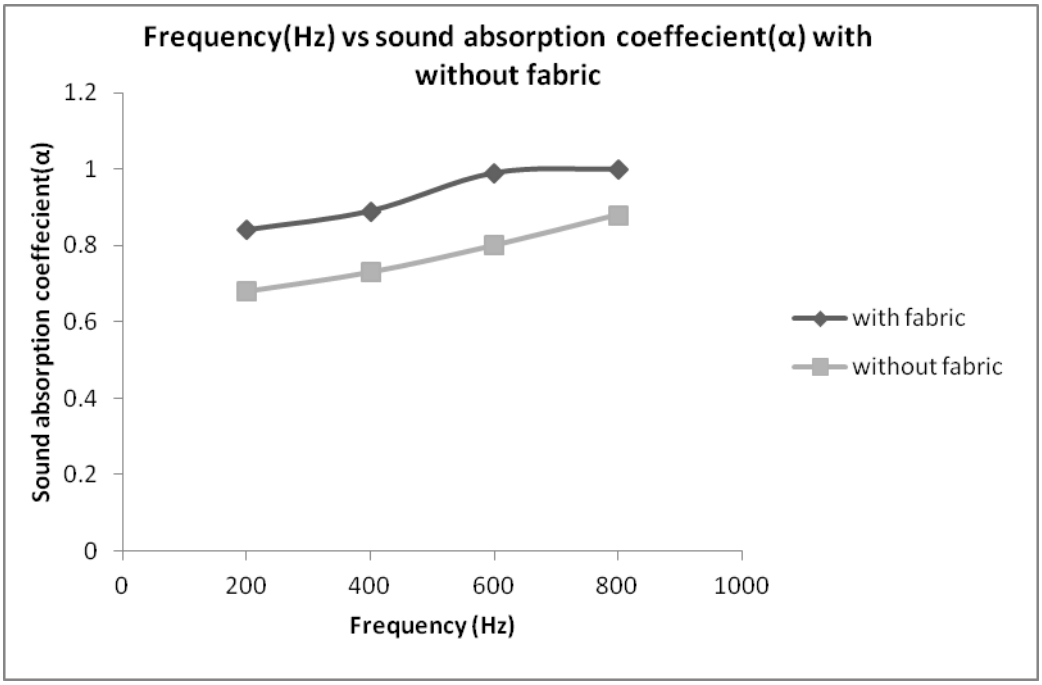


Figure2: Frequency vs absorption coefficient for sample of 3.68mm thickness.

A comparative of property of sound absorption coefficient is studied on the basis of thickness of sample as shown below.

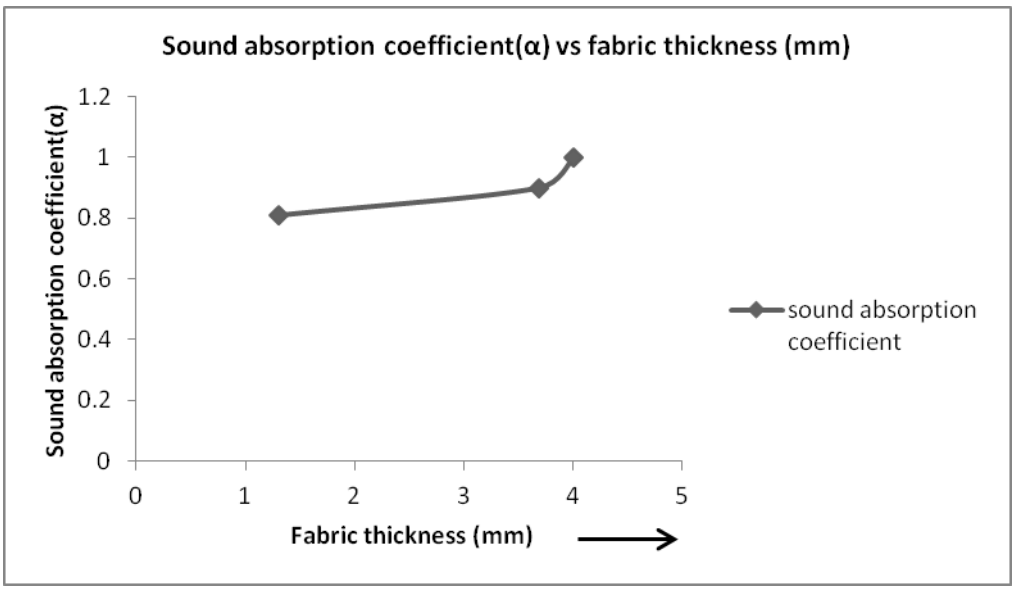


Figure3: Graph shows that as thickness increased the SAC increase.

The figure1 and 2 shows that as the frequency of source increases the value of absorption coefficient vary and at the higher values of frequency the absorption properties of non woven material enhanced. As with the graph of figure 3 it is clear that when a material with more thickness is used than the sound gets greatly absorbed and hence less noise is produced.

Future work in the field is going on, we are in investigation of various auto textile materials which are used in SUVs, Medium size and small size automobiles. A detail search is going on at NITRA in which the absorption coefficient of various materials on their pattern, roughness smoothness is in progress.

Acknowledgement
I wish to thanks the team of NITRA for their kind support in the entire work.

Reference:

[1] Br¨uel & Kjær Technical review no. 1 Jan 1949.
[2] ASTM E1050, Standard test method for impedance and absorption of acoustical materials using a tube, two microphones, and a digital frequency analysis system.
[3] http://www.nitratextile.org/pdf/testing/chemical-quality-evaluation-laboratory.pdf
[4] "Instructions and Applications" for Standing Wave Apparatus Type 4002 and Frequency Analyzer Type 2107, (Br¨uel & Kjær, 1967).
[5] Kinsler, Frey, Coppens, and Sanders, Fundamentals of Acoustics, Third Edition, (John Wiley & Sons, 1982), Chapter 9.
[6] Reynolds, Engineering Principles of Acoustics: Noise and Vibration Control, (Allyn & Bacon,1981).
[7] Elmore and Heald, Physics of Waves, (Dover reprint, 1985), Appendix B.
[8] Leping Feng, Acoustical measurements, Lecture notes, TRITA-AVE 2007:07, ISSN 1651-7660, 2nd print (2008).
[9] ISO 10534-2, Acoustics – Determination of sound absorption coefficient and impedance in impedance tubes – Part 2: Transfer-function method.