DETERMINATION OF SOUND ABSORPTION FOR ABSORPTIVE MATERIAL USING A TWO-MICROPHONE IMPEDANCE MEASUREMENT TUBE TYPE 4206 (B&K)

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With the growing focus today on noise-control issues and the emergence of sound quality as an important aspect of product design, acoustic material testing is becoming increasingly relevant to researchers, engineers, designers and manufacturers from a broad range of industries. Products like bio-composites, fibre-reinforced plastics, felt and insulators are being used as sound dampening components, and it is therefore crucial to predict the impact of using specific noise-control materials at an early stage in the development of those components or products. Representing the real application of the product, this testing can help to predict if the acoustic characteristics of the materials have been accurately specified. Many different methods can be used to determine the acoustic properties of materials. The most critical property here is the normal incidence sound absorption coefficient, which is a function of frequency valued between zero and one. Sound absorption is the percentage of sound energy being absorbed by the sample material. This is the primary indicator of the way any barrier material will react in any given environment.

SOUND ABSORPTION TESTING SERVICE

MPOB has a sound absorption test unit which comprises a two-microphone impedance measurement tube Type 4206 located at the Agro Product Unit. The impedance tube test is used to measure the acoustic parameters of small test samples including the absorption coefficient, reflection coefficient and normalized impedance, in the range of 50 Hz to 6.4 KHz. The known established methods for measurement of sound absorption based on the two-microphone impedances are ISO 1534-2 and ASTM E1050-98. The service offers two complete measurement set-ups at a low frequency (large tube) and at a high frequency (small tube) to measure parameters in the frequency ranges from 50 Hz to 1.6 KHz, and from 500 Hz to 6.4 KHz, respectively.

Sound absorption is determined when the signal is generated by a sound source, and the incident and reflected components are determined from the relationship between the acoustic pressures measured by the microphones at two locations on the wall of the tube (*Figure 1*).

Components of the two-microphone impedance measurement tube Type 4206 for standard large and small tube set-ups are shown in *Figure 2*.

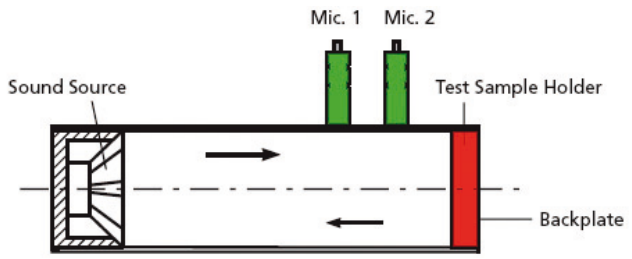

Figure 1. Schematic diagram of the impedance tube for the two-microphone transfer-function method.

Figure 2. Type 4206 impedance tube standard large (above) and small (below) set-ups.

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ADVANTAGES OF THE IMPEDANCE TUBE TEST

The service offers fast and accurate measurements with pre-determined normal incident parameters. An example of the test result is shown in *Figure 3*.

A large frequency range can be achieved by using tubes of various diameters and different microphone spacings. Only small samples are required for testing in tubes with diameters of 29 mm (small) and 100 mm (large).

The samples should be delivered in dimensions of 30 cm x 30 cm for testing. The results from five replications of the test for each sample will be averaged to give a better estimation of the acoustic properties of the material. A comprehensive report will be provided with appropriate recommendations on request.

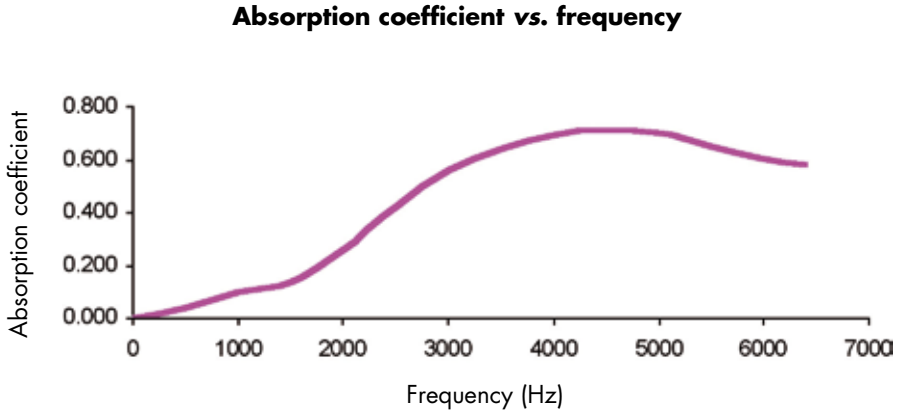

Figure 3. An example of absorption coefficient of a material measured using the impedance tube.

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