

PARAMETRIC STUDY OF LAYERED ABSORPTION MATERIALS

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1. INTRODUCTION

The knowledge of basic phenomena governing the absorption performance of materials is part of the basic knowledge of acoustic consultants. The accuracy of acoustic designs depends strongly on the correct estimation of surfaces absorption properties. However, the comparison of absorbers is often unreliable because absorption data has been determined using different methods. Product catalogues, scientific publications, experience prediction models are used to determine the absorption coefficients during acoustic design.

The problem occurs, particularly, when multiple layer constructions are used but product data is not available. Absorption mechanism can be determined by different absorption mechanisms at the same time: resistance loss, viscosity loss, panel resonance, and Helmholtz resonance.

The aim of this study was to investigate the effect of different layer parameters on absorption coefficient. The study was carried out experimentally by determining the absorption coefficient of several layered materials.

2. MATERIALS AND METHODS

The measured systems included glass, rock and polyester wools, perforated metal plates and gypsum boards, plastic foils, and several combinations of these. The total number of samples tested was 39, and of total systems was 343. The measurements were performed in an impedance tube. The frequency range investigated was **125-2500 Hz**.

3. RESULTS

The results of suspended or unsuspended porous absorbers were consistent with previous results.

The covering of a porous absorber by a perforated steel sheet did not deteriorate the absorption performance if the perforation ratio was above 15 %. Perforation size of 1.3 mm and 4.0 mm gave similar results when the perforation ratio was 15 % or more. If the perforated steel sheet was backed air layer, without porous absorber, the absorption results reminded of the performance of a Helmholtz resonator. The resonance frequency was reduced as the perforation ratio increased.

Plastic foils are used as vapour barriers on the top of porous thermal insulation materials in facades and roofs. Foils reduced strongly the absorption properties of the absorber at high frequencies. If the plastic foil was immersed by 25 mm inside the absorption material, high frequency absorption performances were no longer reduced. There are no building physical reasons to prevent this in practice.

The most important results of this study were the parametric series of absorption coefficients, e.g. Figure 1. They showed very clearly the effect of a single parameter on the absorption coefficient. The results can be used in, e.g. product development, acoustic consultancy and education. All data will be published in English [1].

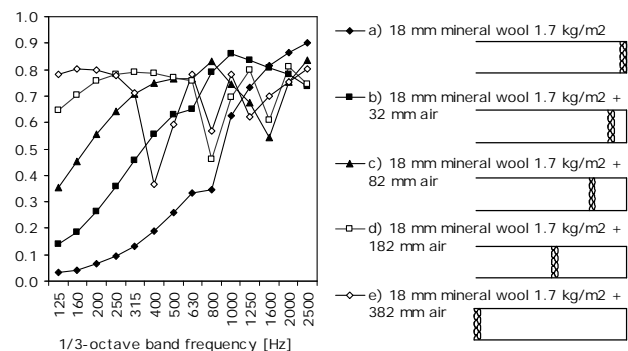


Figure 1. An example of a data set of the study.

[1] Oliva et al, Parametric study of layered absorption materials. Finnish Institute of Occupational Health. (unpublished)