

Acoustic materials - research and development at VTT

Acoustic material is a commonly used term for materials with a significant effect on the sound. The desired effect is usually the sound absorption or insulation. VTT measures, characterises, simulates and develops acoustic materials.



A photograph and an electron micrograph of a 100 mm sample of a sintered UHMWPE absorption material developed at VTT.

VTT supports development of acoustic materials by

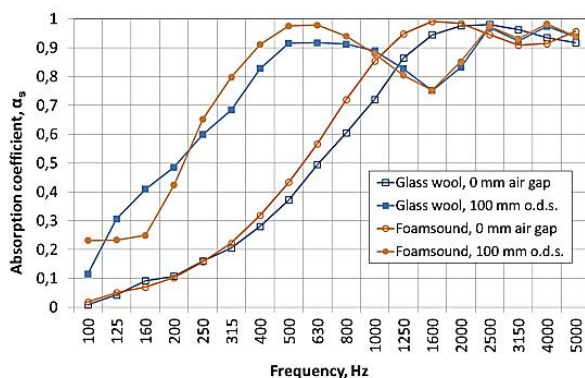
- measurements of sound absorption, flow resistivity and elastic properties \Rightarrow **material parameters**
- fabrication of experimental materials
- optimisation of acoustic materials

VTT helps customers to answer questions such as

- is this material an effective sound absorbent for my application
- how much do I need this material
- can I improve my product by selecting another material

The ability of a material to absorb sound is quantified by **sound absorption**. The absorption coefficient of an ideal absorbent is 1 at all frequencies, and may be calculated when material **impedance** is known.

Sound transmission loss is the ratio of incident power to transmitted power in decibels. A high transmission loss is desirable for good **sound insulation**.



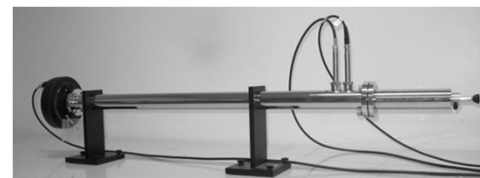
Sound absorption coefficient of 30 mm VTT foam formed pine kraft material, in comparison to 30 mm commercial glass wool absorbent.

The measurement process

Sound absorption is usually measured in **an impedance tube** or a **reverberation room**. Impedance tube requires only about 0,25 m² of sample material. For measurement in reverberation room about 10 m² is needed.

Preparation of samples for the impedance tube measurements is a critical part to obtain reliable data. VTT uses the water jet and laser cutting to prepare precise samples for impedance tube measurements.

Impedance tube measurements are especially useful if the sample material is not readily available in large quantities, or if effect of varying air gaps is studied.



VTT's ACUPRO impedance tube.

Characterisation and modelling

The required data are not usually available and they must be measured for each material. They are usually obtained with the ACUPRO impedance tube. Combined with other measurements, VTT uses FOAM-X and NOVA software to characterise acoustic materials and compute their parameters.

Such parameters are used with simulation methods such as Statistical Energy Analysis (SEA) and Finite Element Analysis (FEM). Realistic modelling of acoustic materials is particularly important in closed spaces such as vehicles. Models of sound absorption are also needed for optimization of acoustic materials.



Foam formed kraft material made at VTT.

Measured materials so far

- Polyurethane foam
- Sintered ultra-high molecular weight polyethylene
- Foam formed kraft fibre
- Mineral wool
- Polyester felt & fibre
- Recycled shoddy
- Microperforated sheet metal
- Sintered rubber grain
- Layered materials

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