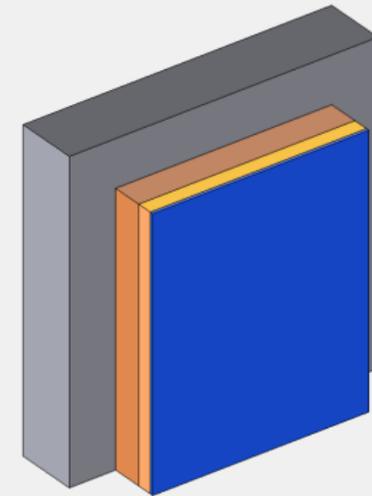
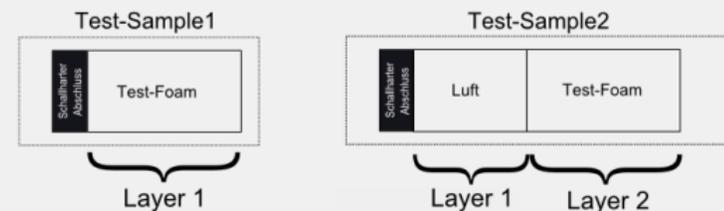


- acoustic design of multilayer absorber systems for
 - room acoustical application for reduction of reverberation time
 - sound absorbing acoustic enclosures for protection against machinery noise
 - sound absorbing silencers for protection against ventilation and exhaust noise
 - noise barriers for protection against road and rail traffic noise
- computational integration of single material layers within defined periphery
 - import of measurement data from AcustiStudio – Module “Sound Transmission”



- definition of multilayer system
 - type of layer / material
 - geometrical dimensions
- definition of calculation model / measured data
 - open porous absorbers / air
 - model according to DELANY-BAZELY
 - model of homogeneous medium
 - phenomenological model
 - import of characteristic absorber values measured in the transmission tube with AcustiStudio – Module “Sound Transmission”
- definition of environmental conditions
- evaluation of acoustic efficiency of multilayer system
 - computation of sound absorption coefficient for defined sound incidence



Sound Absorber Software AcoustiCalc® Absorber

Physical Definition – Modelling & Calculation

Absorber parameters

- φ = open porosity
- σ = airflow resistivity
- k' = thermal characteristic length
- k'_0 = thermal permeability
- τ = dynamic tortuosity
- λ = viscose characteristic length

Structure parameters

- E = Youngs modulus
- μ = Poisson ratio
- η = loss factor

Absorbing properties

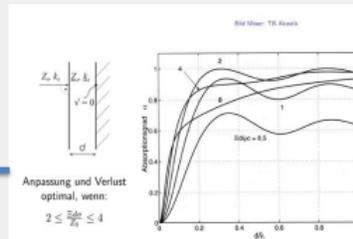
- α = sound absorption coefficient
- Z_W = complex surface impedance

Absorber model

Characteristic absorber values

- Z_a = complex characteristic impedance
- k_a = complex wave number
- or
- ρ_{eq} = complex dynamic mass density
- K_{eq} = complex dynamic bulk modulus

Absorber arrangements,
e. g. absorber in front of
wall, silencer



Sound Absorber Software AcoustiCalc® Absorber

Physical Definition – Measurement & Calculation

Application of Transmission Tube AcoustiTube®



Direct measurement

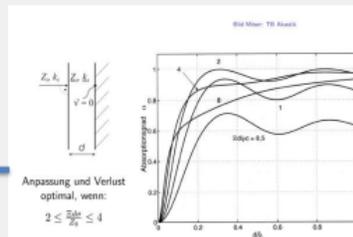
Characteristic absorber values

- Z_a = complex characteristic impedance
- k_a = complex wave number
- or
- ρ_{eq} = complex dynamic mass density
- K_{eq} = complex dynamic bulk modulus

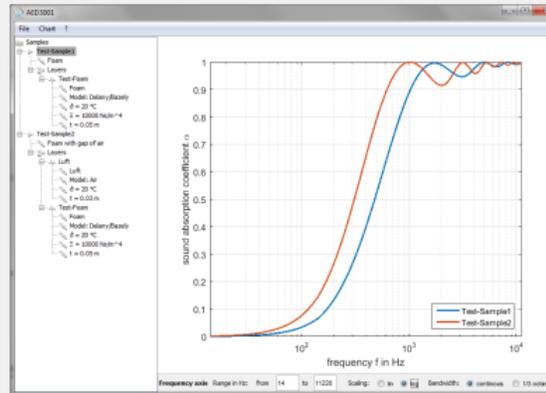
Absorber arrangements,
e. g. absorber in front of
wall, silencer

Absorbing properties

- α = sound absorption coefficient
- Z_W = complex surface impedance



- determination of sound absorption coefficient of multilayer systems as a function of frequency
- consideration of normal / angular / statistical (diffuse) sound incidence
- prediction of rated sound absorption coefficient according to DIN EN ISO 11654
- **measurements from AcustiStudio can be loaded directly (no ASCII export/import)**



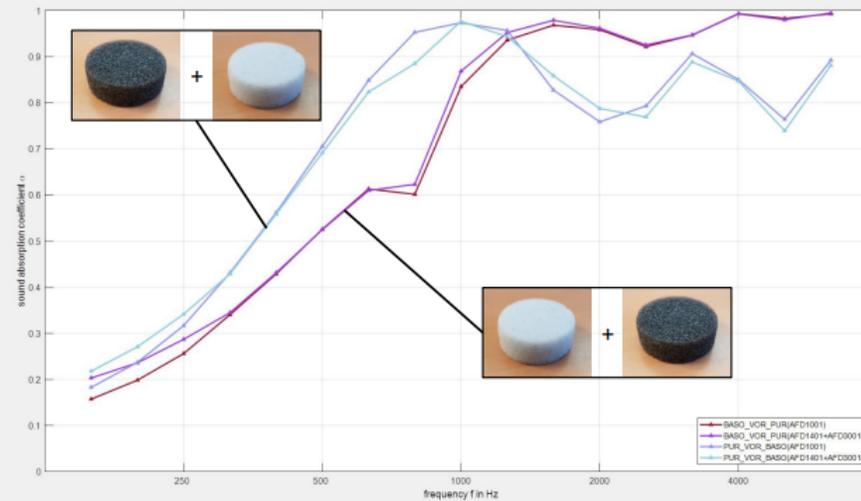
- sound absorption coefficient of two pairs of sound absorbing materials
 - 1 cm melamine foam in front of 1 cm PUR foam
 - 1 cm PUR foam in front of 1 cm melamine foam



Sound Absorber Software AcoustiCalc® Absorber

Simulation vs. Measurement Results

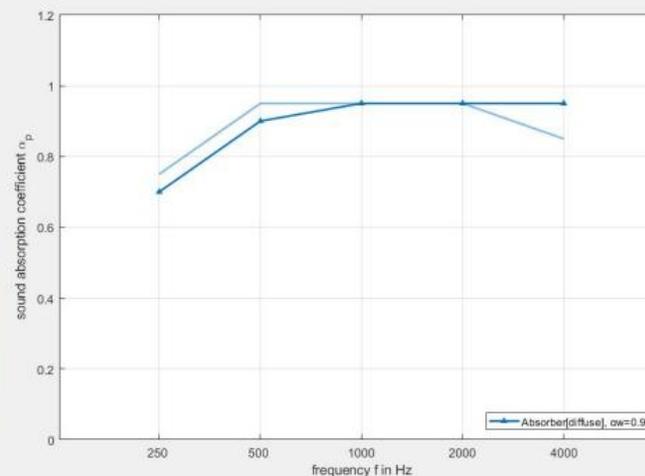
- comparison of measurement results in the impedance tube with simulation results based on the characteristic absorber values measured in the transmission tube



Sound Absorber Software AcoustiCalc® Absorber

Simulation Results

- prediction of rated sound absorption coefficient on the basis of calculation results of sound absorption coefficient for statistical (diffuse) sound incidence for direct comparison to results of measurements in the reverberation chamber and/or the Alpha cabin



- octave spectrum of sound absorption coefficient
- shifted rating curve
- α_w rated sound absorption coefficient