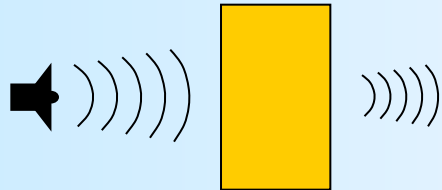


Acoustic Properties of Aluminium foam

Fraunhofer-Institut für Fertigungstechnik und Angewandte
Materialforschung, Bremen

Acoustic Properties - Overview

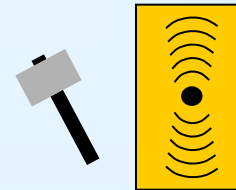
Airborne Sound



Sound absorption coefficient α [%]

- concrete 1
- glass 3
- **Al foam 10**
- sound absorbing materials (PE fibres) 50

Structure borne Sound



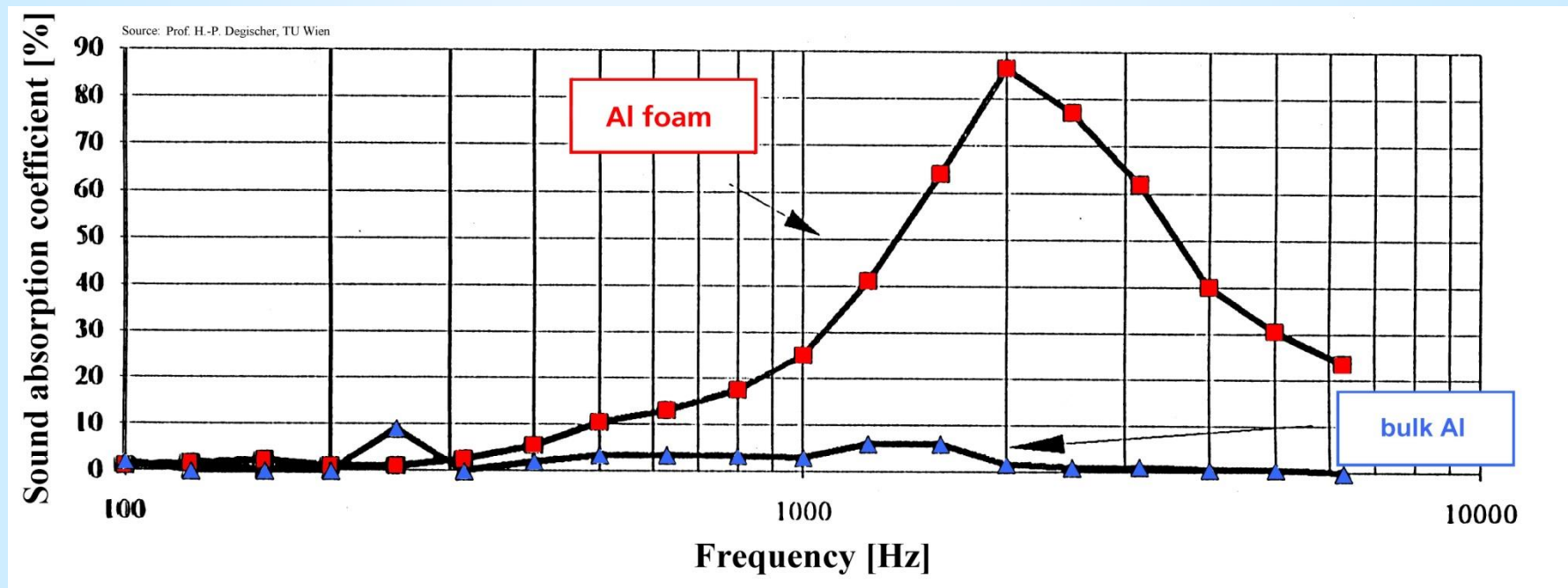
Loss factor η [-]

- conventional Al (solid) 10^{-4}
- **Al foam 10^{-3}**
- plastics 10^{-2}

Acoustic Properties - air borne sound

Sound absorption coefficient

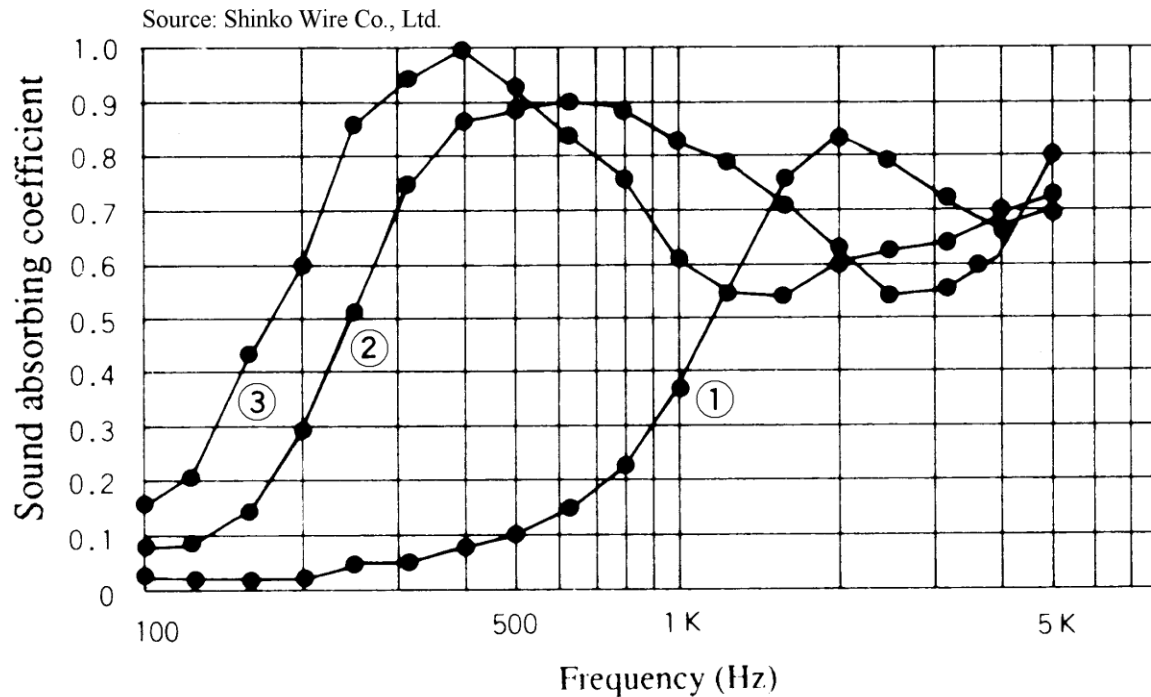
as function of excitation frequency measured for Al foam produced according to the IFAM process (foam density approx. 0.5 g/cm^3 , surface cut off)



Acoustic Properties - air borne sound

Sound absorption coefficient

as function of excitation frequency measured for ALPORAS foam (foam density approx. 0.37 g/cm^3 , surface cut off)



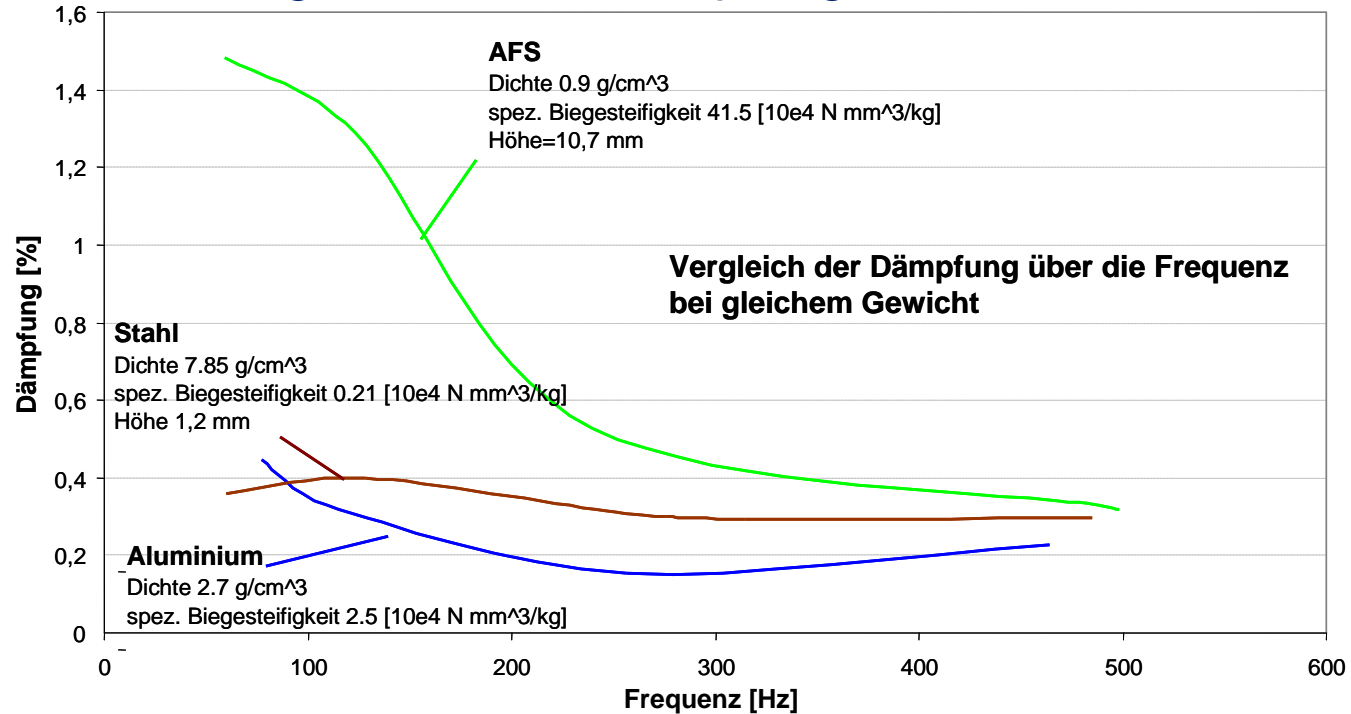
ALPORAS Sound Absorbing Material
RH09 ($\rho = 0.37$)

- ① Air layer 0 mm
- ② 50 mm
- ③ 90 mm

(Using the same panel)

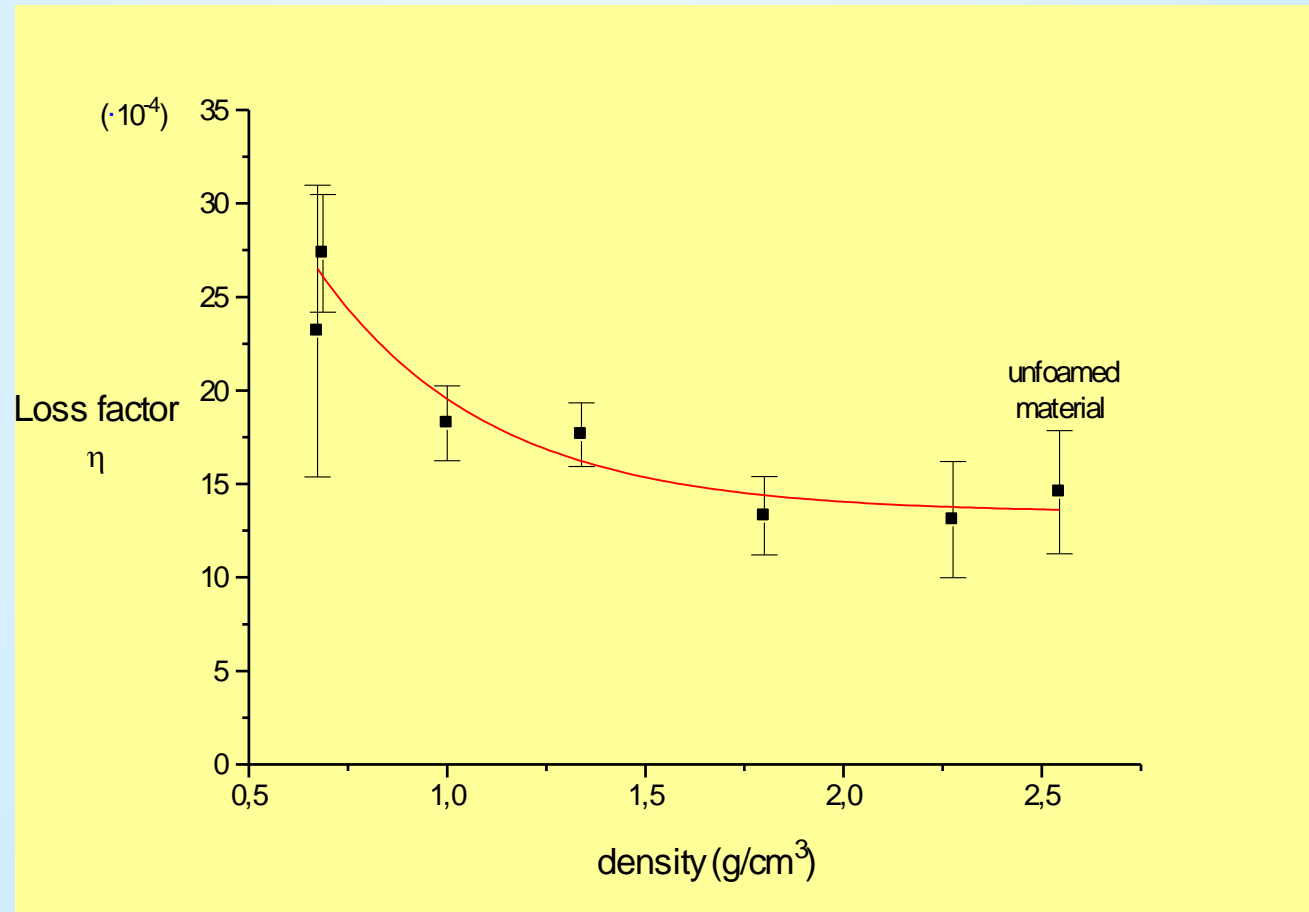
Aluminium foam sandwich AFS

Materialeigenschaften, Dämpfung



source: Karmann

Damping properties (structure borne sound) of p/m Aluminium foam



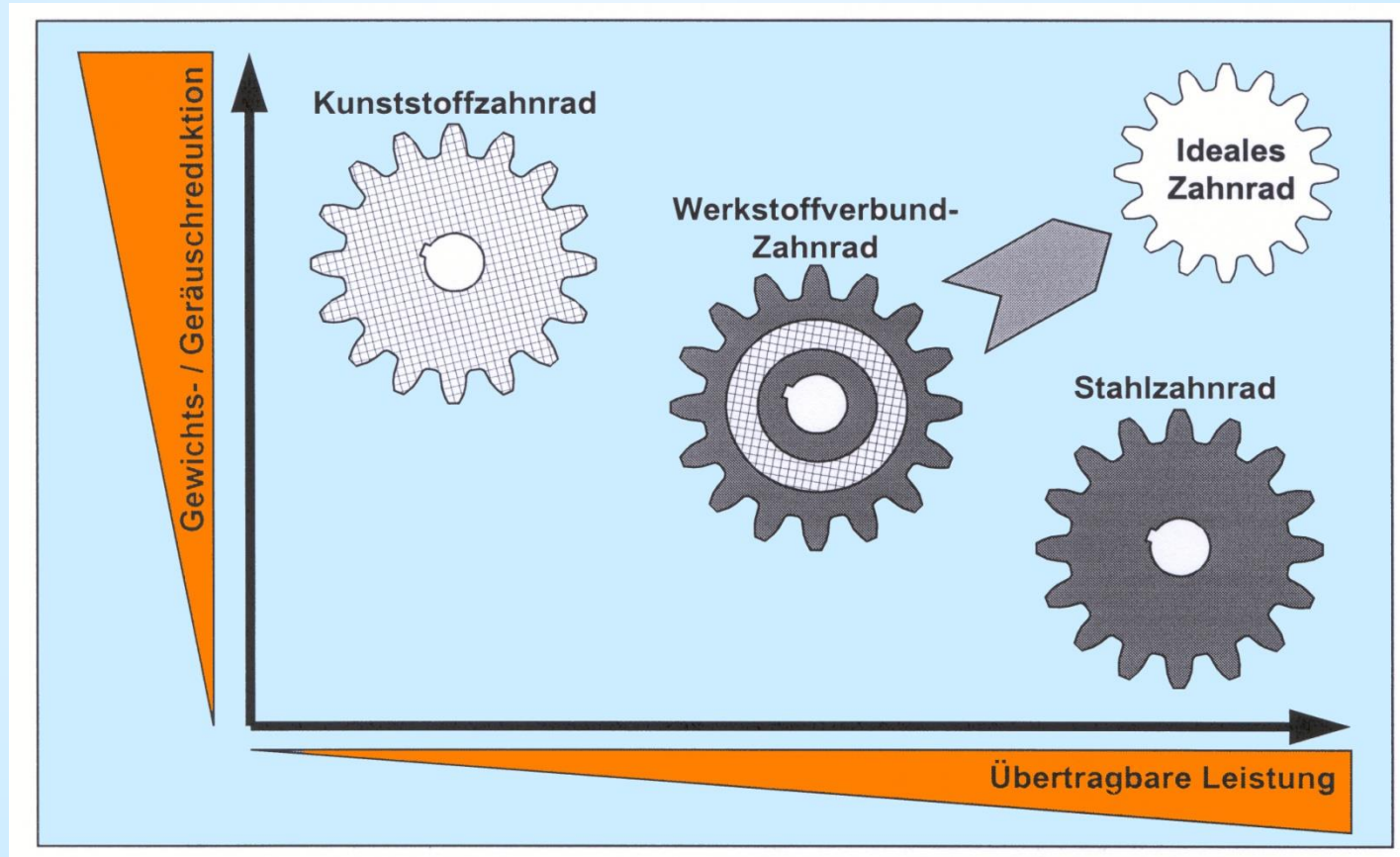
example: arm of a textile machine



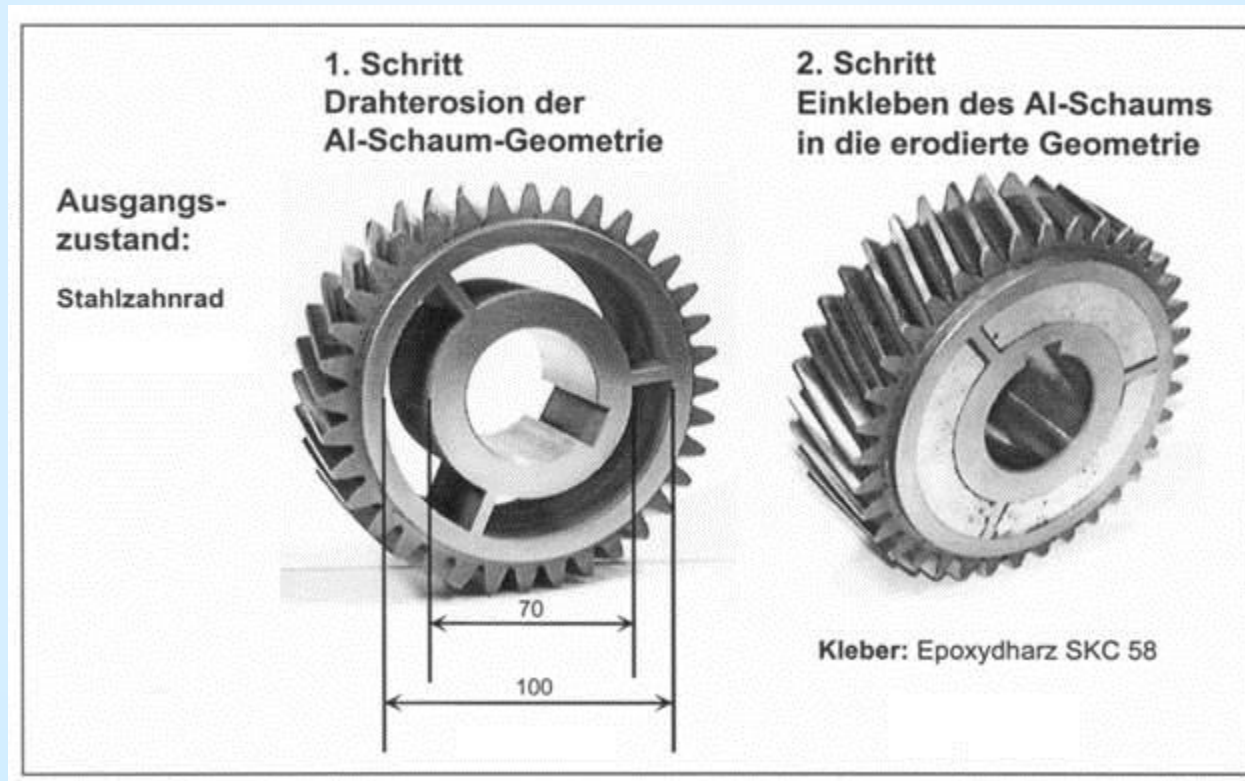
Textile machine arm with an Alporas
foam core : 1590mm x 280mm x
160mm, 60% reduced amplitude of
resonance frequency, production:
appr. 1000/a

source: von der Au Metallgießerei

Example: sound reduction of a gear wheel



gear wheel: manufacturing steps



m=4625 g

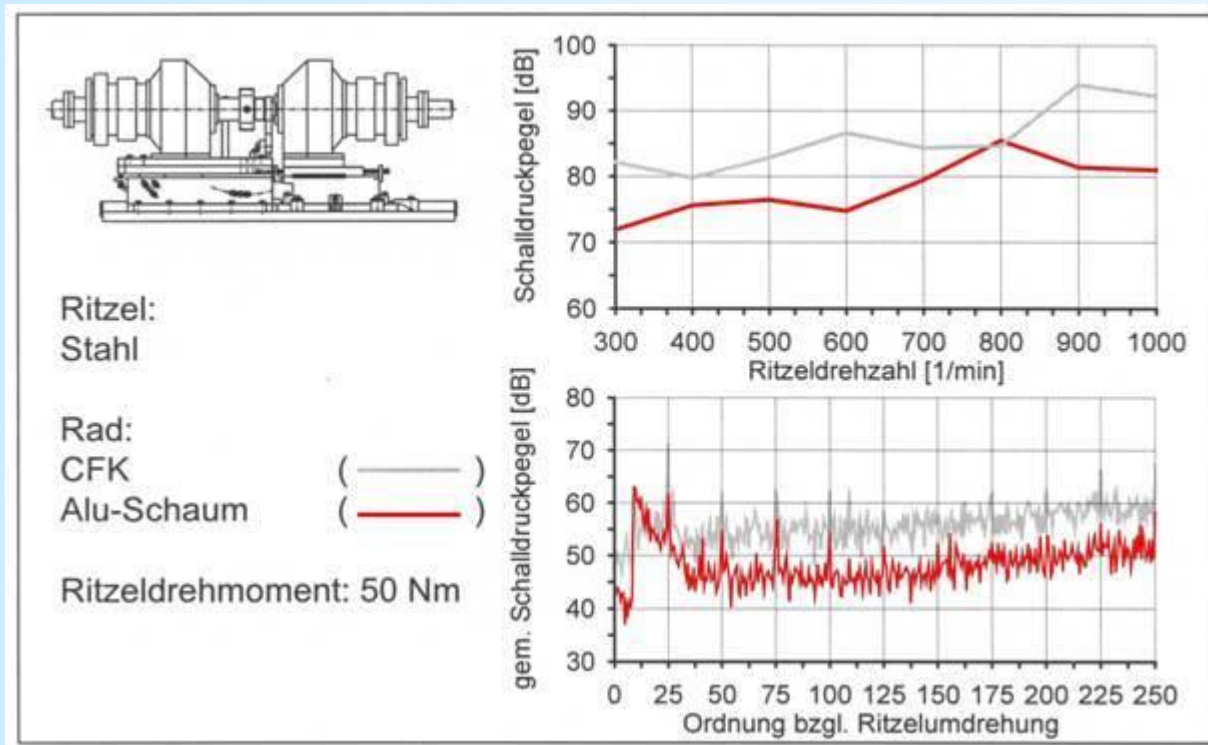
m=3030 g

m=3156 g (-32 %)

gear wheel: 2nd generation

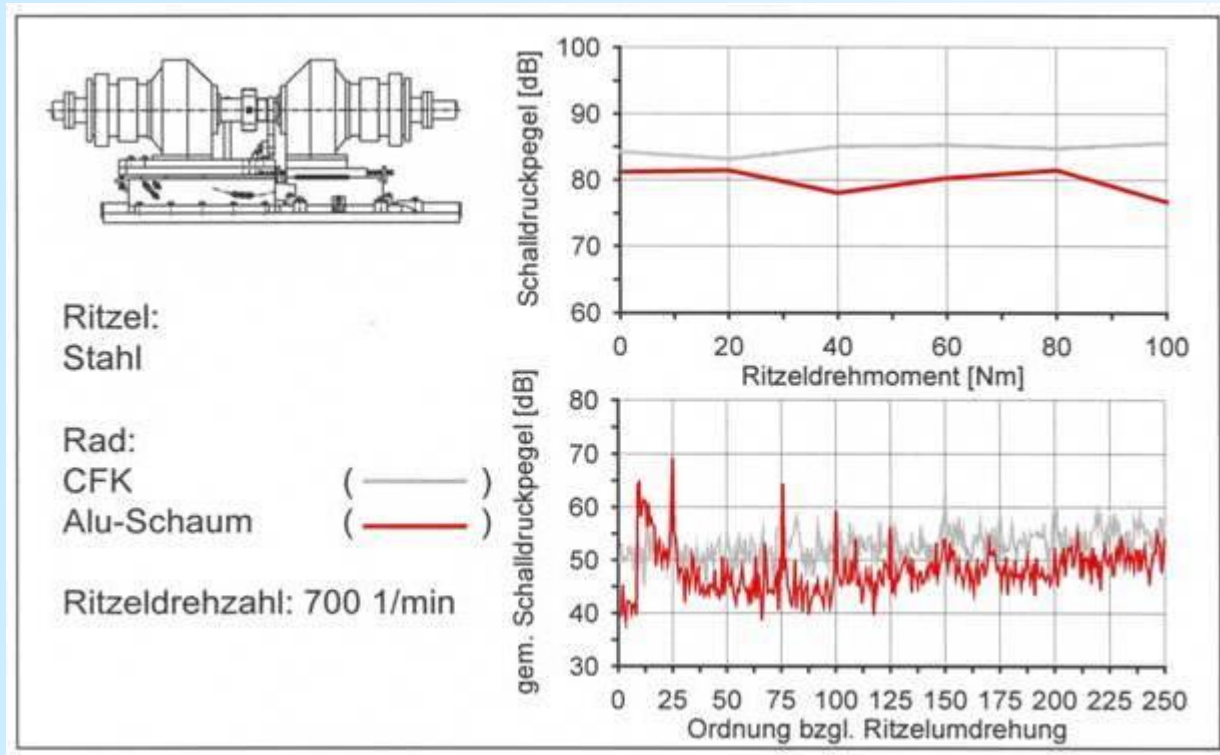


Sound pressure level vs. rotational speed (torque = 50 Nm) Comparison: Al foam <-> CFK (carbon fibre reinforced plastic)



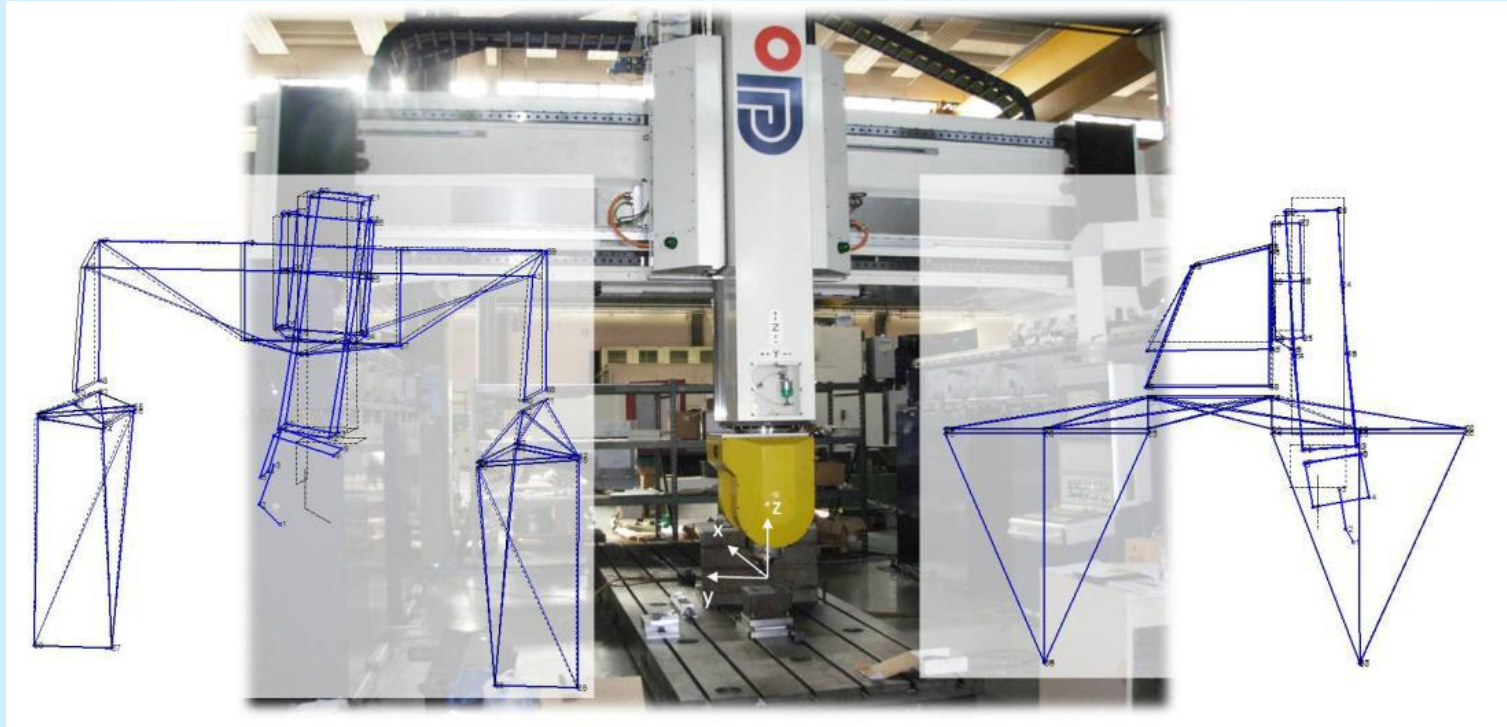
- sound pressure level of Al foam is below that of CFK for all rpm (exception: 800 1/min).
- reduction of the sound pressure level up to 10 dB
- peak values and general niveau are reduced

Sound pressure level vs. torque (rotational speed= 700 1/min) Comparison: Al foam <-> CFK (carbon fibre reinforced plastic)



- sound pressure level of Al foam is below that of CFK for all rpm values
- reduction of the sound pressure level up to 8 dB
- peak values and general niveau are reduced

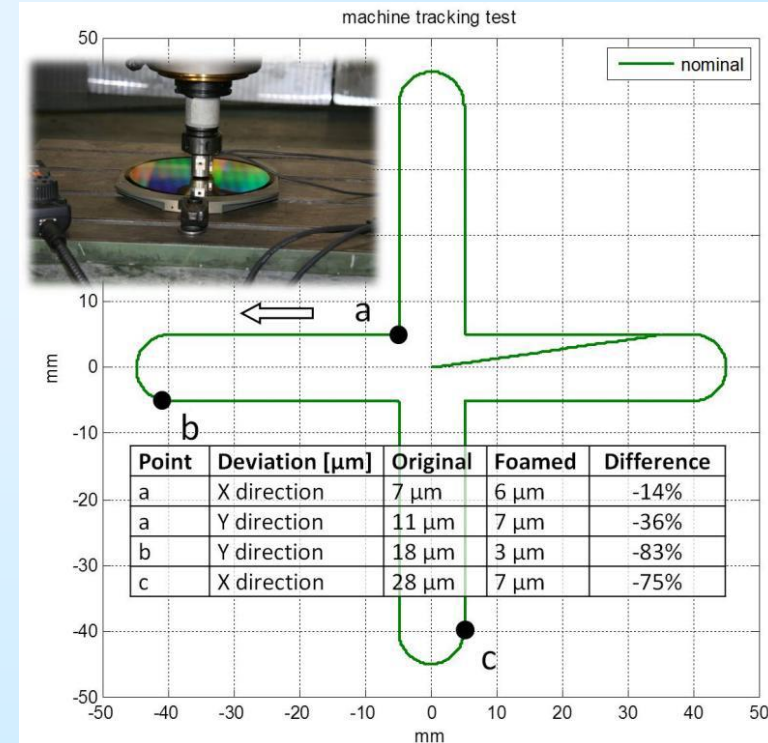
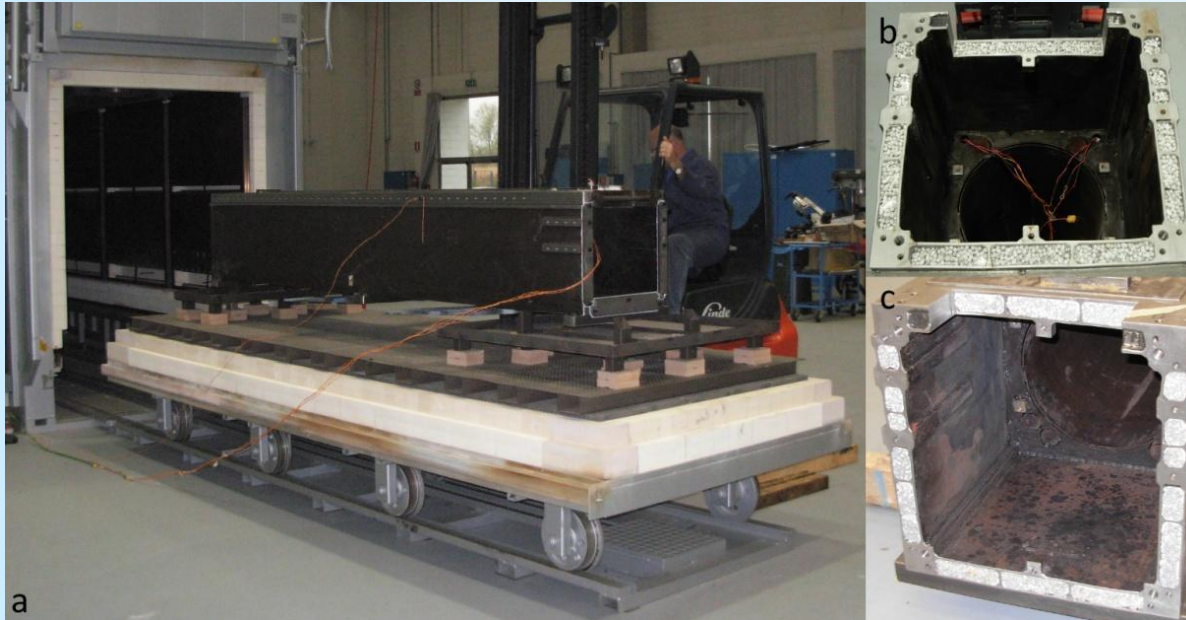
Damping of APM Aluminium hybride foam ram of a 5-axis milling centre



→ aim: improvement of tracking accuracy and material removal rate

Damping of APM Aluminium hybride foam

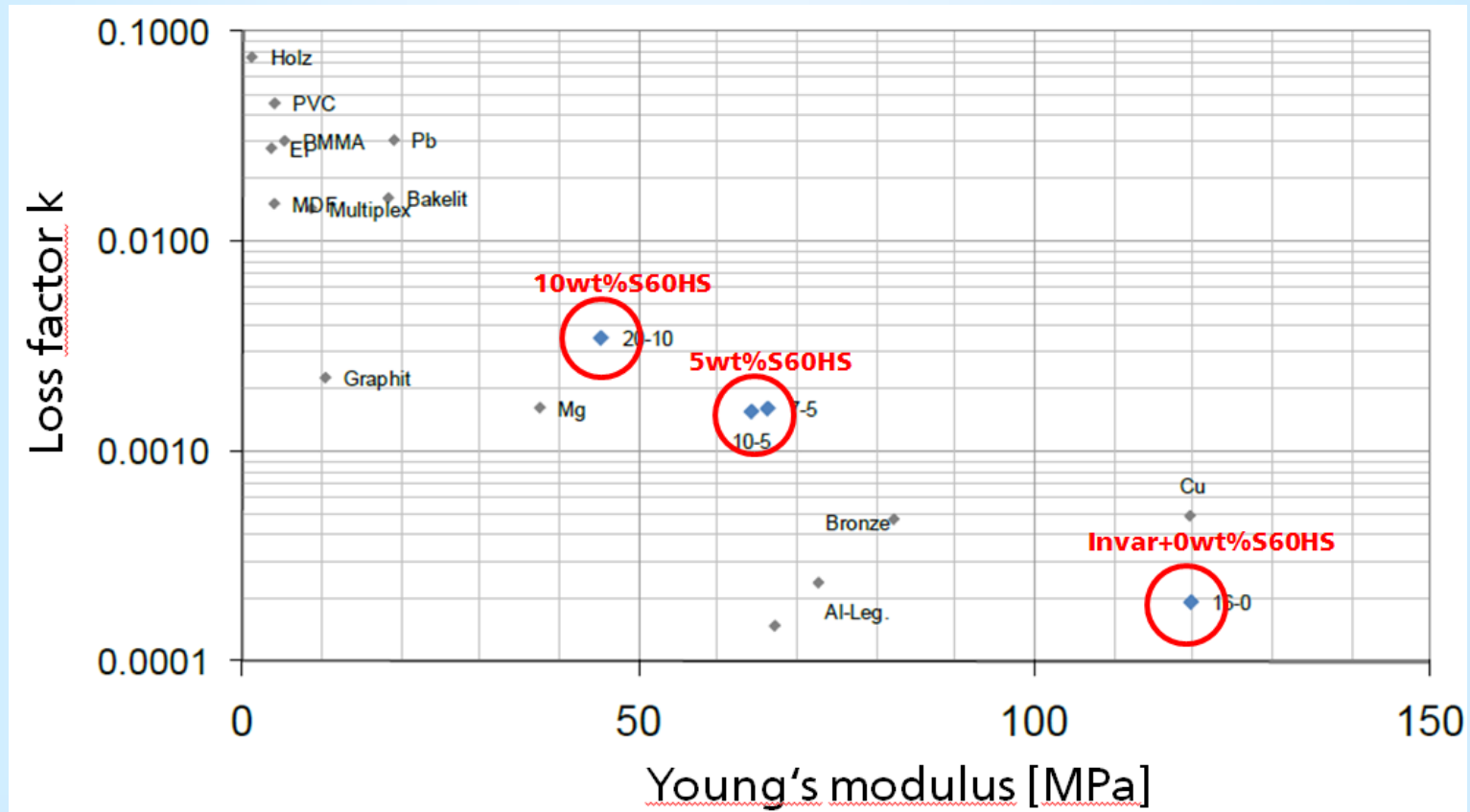
ram of a 5-axis milling centre



→ tracking deviations reduced by 50%

→ material removal rate increased by 100%

Damping properties of syntactic metal foam



loss factor of syntactic INVAR foams (FeNi36)

Sound velocities of syntactic metal foams

Material	Density [g/cm ³]	Sound velocity (longitudinal) [m/s]	Sound velocity (transversal) [m/s]
AlSi9Cu3	2.70	6320	3130
AlSi9Cu3-S60HS foam	1.26	4510	2570
Zinc alloy 410	7.14	4170	2410
Zinc alloy 410 - S60HS foam	2.24	3330	1935

- reduced sound velocities
- suitable as impedance matching material