IN-SITU ABSORPTION

In-situ method to measure material properties

Product leaflet

MICROFLOWN TECHNOLOGIES

In-situ testing

NON-DESTRUCTIVE ACOUSTIC MATERIAL TESTING

Traditional absorption measurements often rely on laboratory setups that require cutting samples or altering how they are mounted. The In-situ Absorption solution changes this by measuring sound pressure and particle velocity directly on installed materials, revealing how they perform under real conditions, without damage or removal.

Compact and portable, the system is ideal for quick on-site verification or in-depth studies of wall panels, floor coverings, acoustic foams, or automotive trim parts. It provides immediate, reliable results under actual boundary conditions, helping designers validate materials during installation, verify supplier data, and perform rapid quality control in the field.

Main system features
IN-SITU ABSORPTION AT A GLANCE

The In-situ Absorption system measures the normal incidence sound absorption coefficient and complex surface impedance of materials using a particle velocity-sound pressure (PU) probe. Unlike conventional impedance tubes, this technique works directly on installed materials.

The system delivers broadband results from 300 Hz to 10 kHz, covering both low-frequency behavior and high-frequency absorption characteristics. Its compact probe geometry ensures minimal surface disturbance and allows precise positioning on vertical, horizontal, or curved surfaces. Within seconds, users obtain the absorption coefficient, reflection coefficient, and complex impedance of the tested material, all displayed in VELO software platform.

Practical, lightweight, and field-ready, the In-situ Absorption system bridges the gap between laboratory precision and real-world conditions. Whether used in construction, automotive, or aerospace applications, it provides confidence that measured performance truly reflects the installed acoustic behavior.

Key features

- Frequency range 300Hz - 10kHz
- In-situ method for testing:
  Acoustic Impedance
  Sound reflection
  Sound absorption
- Non-destructive testing method
- Flat & curved surfaces
- Homogeneous & inhomogeneous materials
- 2D absorption mapping

From handheld inspections to lab testing

ADAPTABLE BY DESIGN

Behind every In-situ Absorption measurement lies a detailed acoustic model built to capture the behavior of materials under real-world conditions. Beyond recording sound pressure and particle velocity, the method combines free-field measurements with sample-based analysis, extending its accuracy well beyond the boundaries of traditional laboratory setups.

Each sample is characterized through two measurements: a free-field capture, where the source excitation is defined by measuring the incident sound pressure and particle velocity; and a sample measurement, performed close to the material under investigation, where the net sound field (composed of both incident and reflected waves) is recorded.

The software then reconstructs the acoustic properties of the material by combining both datasets through a dedicated mathematical model. From this, the complex reflection coefficient, surface impedance, and absorption coefficient are automatically derived.

To ensure accuracy, the algorithm applies phase and amplitude corrections, accounting for the probe geometry as well as environmental factors such as temperature and humidity. The result is a robust method that delivers consistent results even on complex, rough, or layered materials, conditions where conventional impedance tubes often fail.

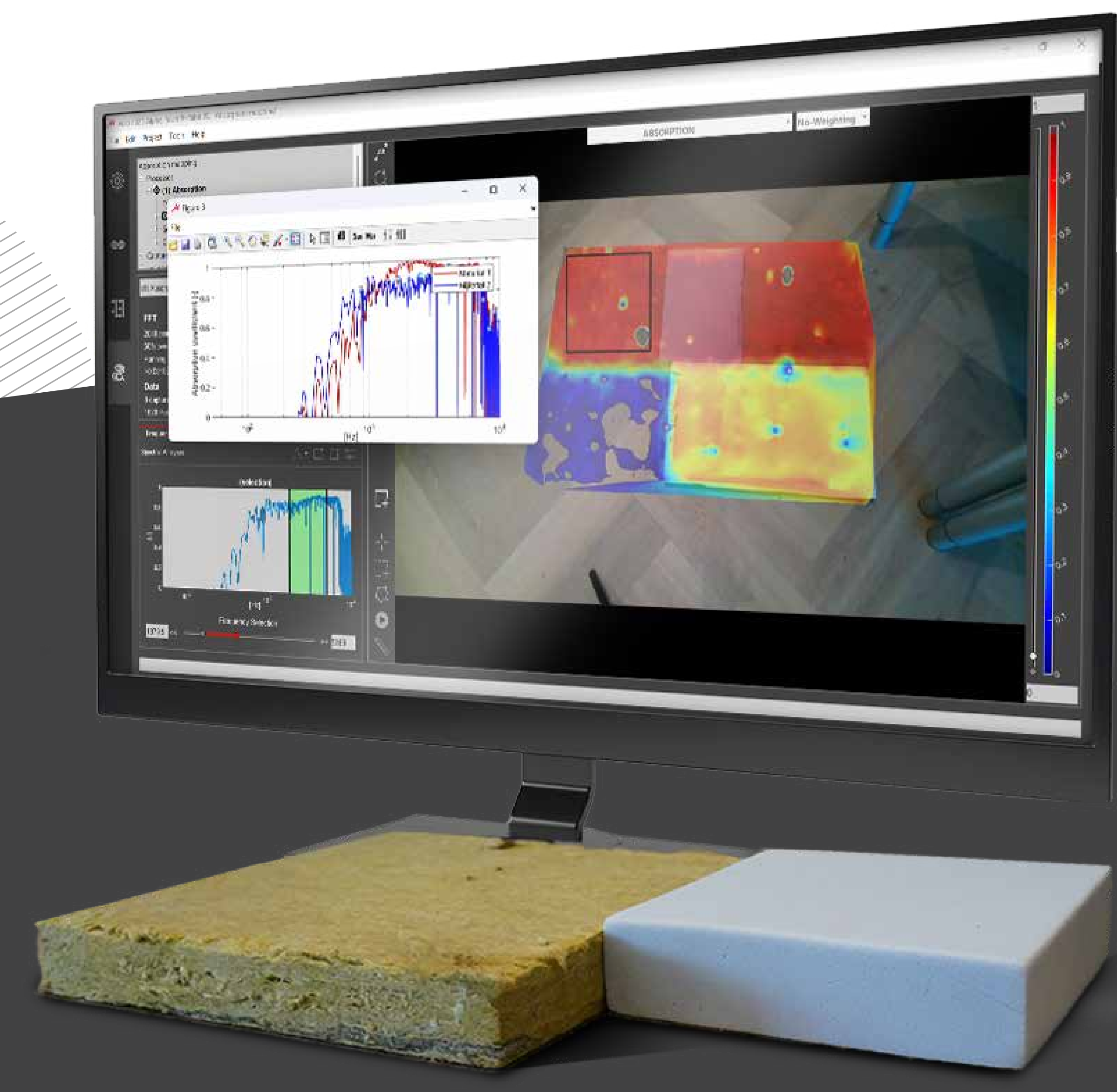
Validated across multiple independent studies, the In-situ Absorption method shows strong correlation with standardized techniques such as ISO 10534-2, while offering a far more practical and portable solution for engineers in the field. Combined with the absorption mapping feature, it enables both point and spatially resolved testing, bridging the gap between material research and real-world applications.

2D ABSORPTION MAPPING

The In-situ Absorption Pro configuration introduces an advanced mapping mode that extends traditional point measurements into full 2D visualizations. Using the same probe and hardware setup, users can scan an area and instantly generate color maps that show how sound absorption varies across a surface.

This makes it possible to identify local defects, inhomogeneities, or differences in mounting conditions that a single-point test could overlook. All data is acquired and processed within the same environment, ensuring seamless synchronization between absorption results and spatial position.

By transforming individual readings into clear, spatially resolved maps, this feature provides engineers with deeper insight into the acoustic performance of materials, revealing not only how much sound is absorbed, but where.



Intuitive & comprehensive

NEXT LEVEL ACOUSTIC TESTING SOFTWARE

Turning measurements into meaningful acoustic results is where the In-situ Absorption system truly stands out. Integrated within the VELO software suite, it provides a dedicated environment for recording, analyzing, and visualizing absorption and impedance data

Engineers can view absorption, reflection, and impedance spectra, compare multiple measurement points, and validate results insta ntly on site. Each system includes a reference sample used to verify the setup and processing settings, ensuring the accuracy and repeatability of every measurement. The software is available in three configurations (Lite, Standard, and Pro) each combining core functionalities adapted to different user needs.

The analysis toolkit offers a wide range of methods, from the plane wave and mirror source approaches to Q-term analysis and complex impedance evaluation. Advanced features include absorption mapping, post-processing of tracked data, and time-based exclusion lists for transient event removal.

All results can be exported in .xlsx and .csv formats for seamless reporting and integration into external workflows. Whether used for quick field checks or detailed research studies, VELO combines clear visual feedback with the precision of laboratory-grade analysis.

What began as a research tool for acoustic materials has evolved into a complete material characterization platform, empowering engineers to measure, compare, and communicate results with confidence.

Advanced Material Characterization

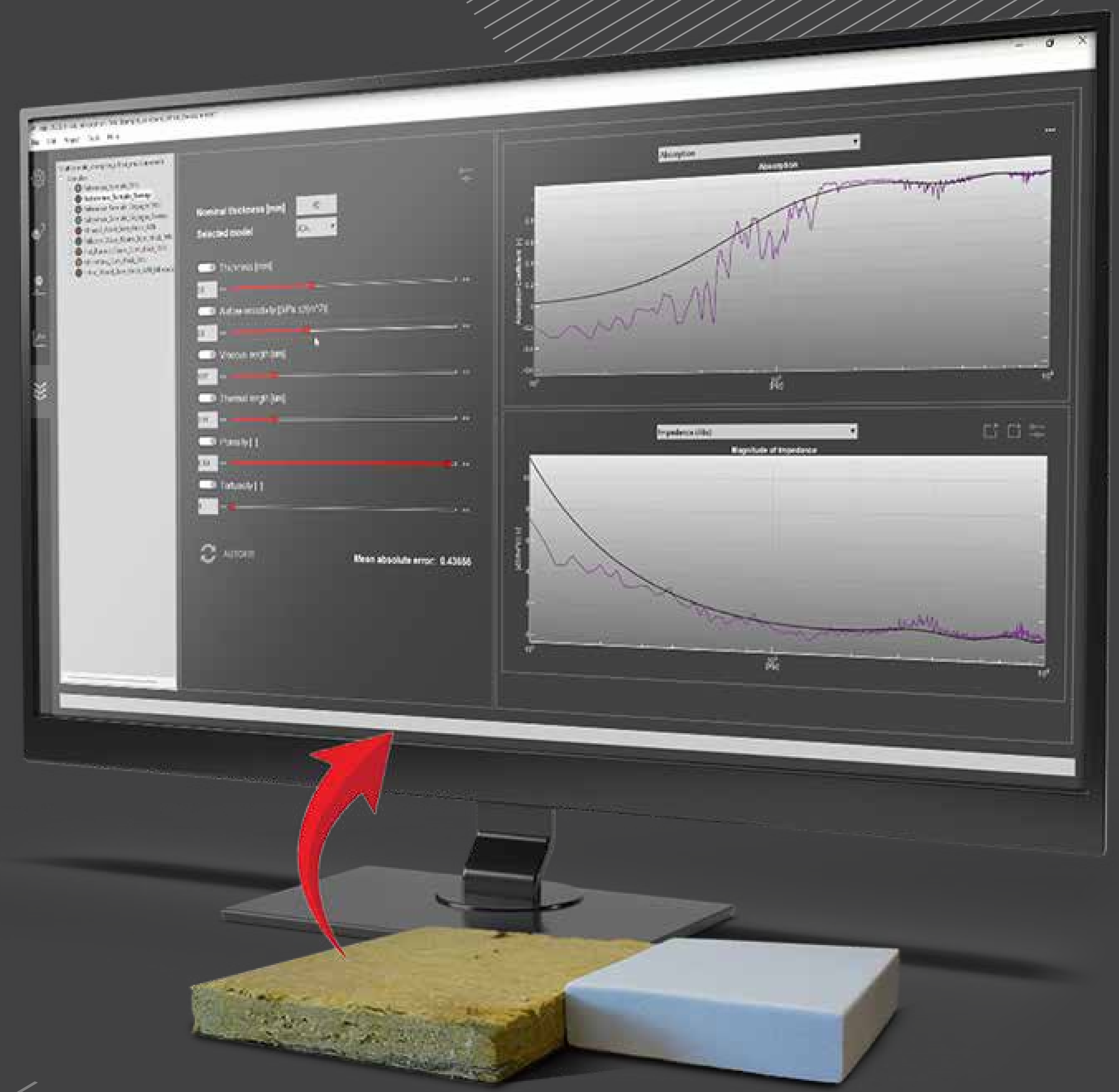
MODEL FITTING FOR IN-SITU ABSORPTION

The In-situ Absorption module now offers enhanced capabilities for material analysis directly in the field. This feature allows for precise and non-destructive characterization of acoustic properties, providing critical insights into material behavior under real-world conditions. By integrating advanced model fitting techniques, users can obtain reliable data without the need for traditional laboratory testing, streamlining the material testing process and enabling faster decision-making.

The new model fitting functionality in the In-situ Absorption module enables advanced material characterization through acoustic impedance measurements. This feature utilizes a comprehensive approach to estimate key material parameters, such as airflow resistivity, effective sample thickness, viscous characteristic length, and other critical factors influencing sound absorption performance.

By comparing the Johnson–Champoux–Allard–Lafarge (JCAL) model to measured impedance data, the system automatically fits the parameters that most significantly impact the acoustic response, providing an accurate representation of material properties under real-world measurement conditions. This non-destructive method allows for quick, reliable material characterization without the need for laboratory testing, ensuring that results are based on data captured with the actual mounting conditions.

The model fitting process is designed to be both robust and computationally efficient, enabling rapid analysis of multiple samples, ideal for high-volume production environments. This powerful feature not only streamlines the material testing workflow but also enhances the accuracy and consistency of material parameter estimations, offering deeper insights into the materials' acoustic behavior in their target environment.



VELO Platform

MATERIAL TESTING WITH EXTENSIVE ANALYSIS OPTIONS

What originally started with sensor technology has become one of the world's most unique instruments for acoustic testing. Microflown Technologies integrates different hardware products with a powerful but user-friendly software package.

IN-SITU ABSORPTION SOFTWARE

	LITE	STANDARD	PRO
Data recording	✓	✓	✓
Smoothing tools	✓	✓	✓
Sound absorption and reflection coefficients	✓	✓	✓
Plane wave method	✓	✓	✓
Mirror source method	✓	✓	✓
Full export options (incl. *.xlsx and *.csv)	✓	✓	✓
Q-term method		✓	✓
Voyager standalone measurement compatibility		✓	✓
Complex impedance		✓	✓
Non-destructive material parameter estimation (model fitting)			✓
Sound absorption mapping*			✓

** Only users who own both a Scan&Paint 2D license (Lite/Standard/Pro) and In-situ Absorption Pro will have access to this feature*

List of included items

HARDWARE OPTIONS

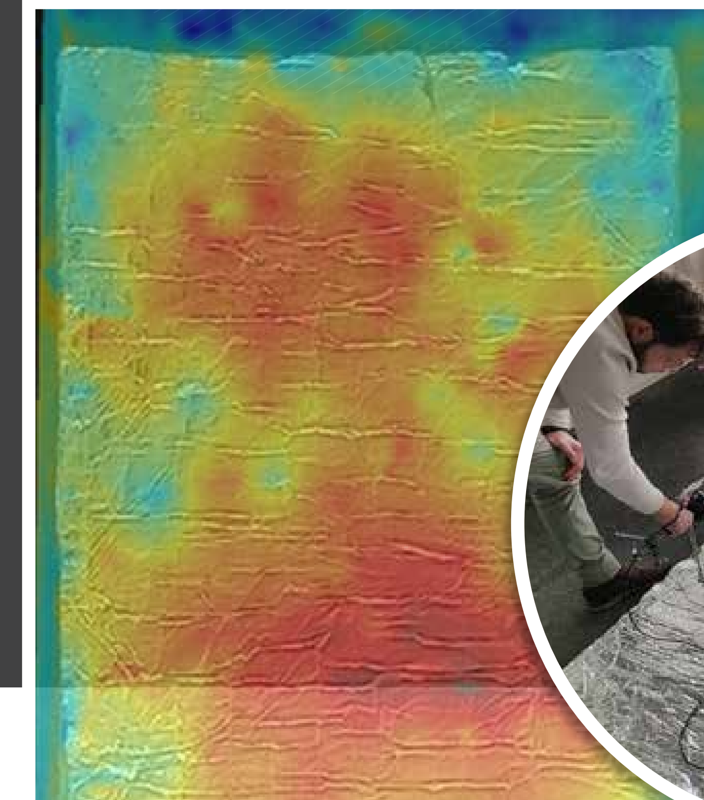
In-Situ Absorption | VOYAGER configuration
Voyager DAQ
- Lanyard
- Sony WH-1000XM4 Headphones
- Tripod Adapter (1/4 to 3/8)
- Firmware Reset Ejector Pin
PU Probe (PI)
- Metal Probe Case
- Calibration Report
Impedance Gun - Rev. 1
Pelicase 1520 + inlay
Cables:
- 2,5 m Impedance Cable - PI-SC
- 3 m high-speed data USB-A to USB-C cable
- 2,5 m speaker cable (mini-jack to banana plugs)
- 2 m USB-A to Micro-B cable
MicroFlown Pre Amplifier 2 channels - Rev. 0
Sentinel HL Max | USB dongle
32 GB USB stick (Calibration report/manuals/software)

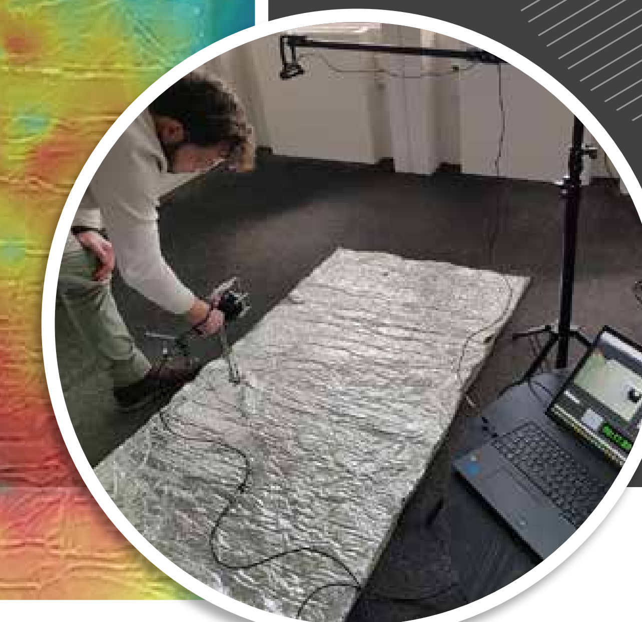
Optional items & accessories
Front-end case for data acquisition units
Extra reference sample pack for periodic system checks
Extended cable set (up to 15 m) for remote operation
Tripod + mounting kit for angled or overhead surface tests

In-Situ Absorption | Scout + MFPA configuration
Scout V2
MFPA-2
Scout/MFPA Stand
PU Probe (PI)
- Metal Probe Case
- Calibration Report
Impedance Gun - Rev. 1
Pelicase 1520 + inlay
Cables:
- 2,5 m Impedance Cable - PI-SC
- 3 m high-speed data USB-A to USB-C cable
- 2,5 m speaker cable (banana plugs)
- 2 m USB-A to Micro-B cable
- BNC cable - 20cm
MicroFlown Pre Amplifier 2 channels - Rev. 0
Sentinel HL Max | USB dongle
32GB USB stick (Calibration report/manuals/software)
Power supply 30W GTM91120 EXCL. C7 powercable
Connection Power supply C7 60W EU
Signal. cond. & Scout foot duo

Uncovering the membrane effect in multi-layered materials
COMPARATIVE ANALYSIS OF ACOUSTIC TESTING METHODS

Multi-layered materials are often used to enhance both acoustic and thermal performance, but accurately characterizing their behavior is far from simple. A recent joint study by Knauf Insulation and Microflown Technologies compared several standardized measurement methods to understand how a thin aluminum foil layer affects the acoustic absorption of a mineral-wool composite. The results revealed a phenomenon known as the membrane effect, which can greatly improve low-frequency absorption but is easily missed by conventional testing techniques.





Goals

The objective of the study was to investigate why traditional laboratory methods, such as the impedance tube and reverberation room, sometimes yield contradictory results when testing complex, layered materials. The team sought to determine which technique provides the most realistic representation of acoustic performance under real-world conditions and to examine the influence of the aluminum foil layer on low-frequency absorption.

Method

Three standardized approaches were compared:

- Reverberation room (ISO 354) – large 10.8 m² sample, diffuse-field conditions.
- Impedance tube (ISO 0534-2) – small circular samples, normal incidence.
- In-situ PU method – portable system measuring sound pressure and particle velocity directly above the surface.

  In addition, absorption mapping using Scan & Paint 2D was performed to visualize how absorption varies spatially across the material. This allowed researchers to correlate local variations with physical features of the top aluminum layer.

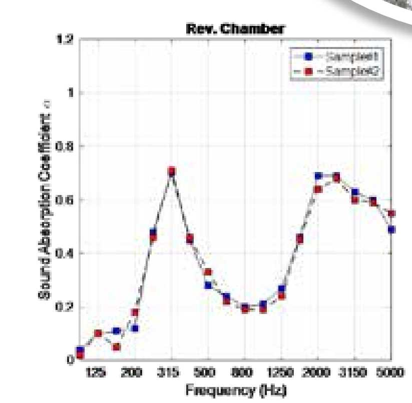
Findings

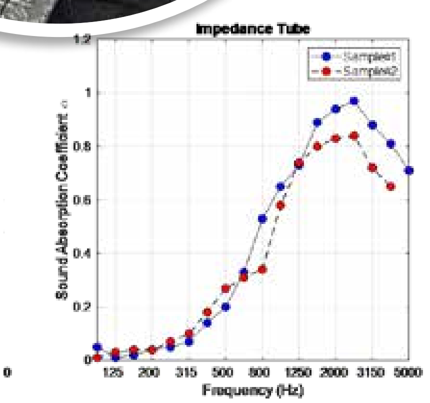
While the impedance-tube results suggested modest performance at low frequencies, both the in-situ and reverberant-room measurements showed a pronounced absorption peak around 315 Hz—evidence of a resonant behavior caused by the flexible aluminum membrane.

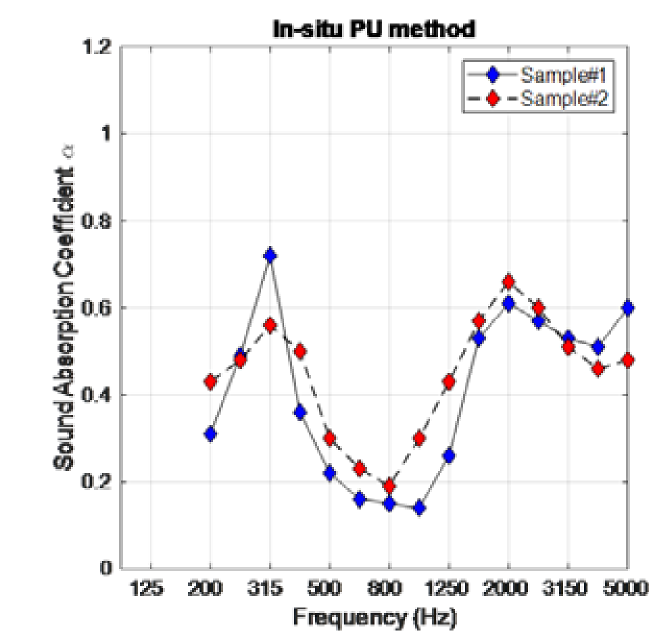
Further experiments confirmed that reversing the sample orientation or re-attaching the foil shifted this resonance to higher frequencies, proving that the thin metal layer acts as a vibrating membrane enhancing low-frequency absorption. The absorption maps also exposed clear spatial patterns, with stronger absorption near the material's center and reduced values at the edges, emphasizing how small-scale defects or variations in layer adhesion can impact performance.

Conclusion

The study demonstrated that in-situ PU measurements align closely with reverberation-room data, offering a practical and accurate alternative to laboratory testing—especially for multi-layered or asymmetric materials. It also highlighted that impedance-tube measurements alone may underestimate low-frequency performance due to the inability to capture membrane effects. Ultimately, this comparative analysis confirms that selecting the right measurement technique is essential for understanding the true acoustic behavior of advanced composite materials.







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