Absorption technology for acoustic test rooms

Sophisticated broadband compact absorber technology can be used for building acoustic test rooms that meet the highest demands and are used by many companies all over the world

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When given the order to design and build an acoustic test room, Faist's acoustic experts precisely analyze the needs of the customer. Then, in most projects, they do not use the conventional wedge absorbers with their pyramid structure that reaches far into the room and demands a lot of space. Instead, the company applies its so-called broadband compact absorber technology.

Reactive sound absorption

This acoustic cladding consists of modules in a sandwich structure with a smooth surface that does not reveal its sound-absorbing function when you look at it. Its intelligence is hidden in the sandwich structure of the modules. Layers of open-cell absorption material are built in an acoustically transparent perforated sheet-metal basket. The layer next to the wall consists of a sheet-metal resonator fixed on an additional acoustic layer. These two components in combination build the compound panel absorber (CPA), a mass-spring system.

The unique combination of the CPA for low frequencies and the open-cell absorber for medium and high frequencies is called the Broadband Compact Absorber (BCA). The BCA provides great sound absorption efficiency over a wide frequency range.

Depending on the calculated mode field of the unclad test room, the free field conditions, especially in the range of low excitation frequencies, are ensured by variable resonators and their selective positioning in the test room. The necessary tools for calculation and simulation were developed at the Fraunhofer Institute for Building Physics in Stuttgart, Germany. They are used in order to meet the free field conditions at the required cut-off frequency.

ABOVE: BMW acoustic test room with BCA cladding in Dingolfing, Germany

Cutting costs

On the one hand the appeal of this wall cladding lies in the highly efficient sound absorption even at low frequencies down to 40Hz. On the other hand the space requirement is considerably lower than for conventional absorbers, as a comparison shows. If a test room with a cut-off frequency of 100Hz is designed with conventional acoustic treatment, a wedge absorber with a total construction length of 0.85m is used. If a cut-off frequency of 50Hz must be reached, the wedges must have a length of 1.70m. The BCA technology, however, gets along with a construction depth of 0.35m – irrespective of the lower cut-off frequency.

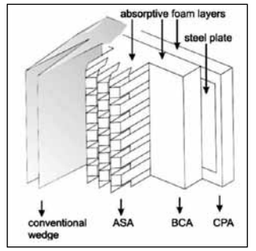
So the user of the test room can save space and costs, also because doors and windows can be realized in a more cost-effective way when using the BCA technology. Moreover, construction time is reduced because the pre-assembled BCA panels are easy to handle and can be quickly installed on-site.

Acceptance measurement by an independent institute

The BCA technology was developed by the well-known Fraunhofer Institute for Building Physics and is proving itself in high-quality anechoic and hemi-anechoic rooms and test rigs all over the world. This has also been confirmed by third-party experts because Faist generally offers the option to have an acceptance measurement carried out by external experts during the commissioning.

Worldwide references

Skepticism is absolutely appropriate if you consider the smooth surface of the BCA panel. Can such a system, which looks anything but absorptive, really meet the high demands of NVH test engineers? As nothing is more convincing than practical examples, you will find here a short description of some projects that have been realized by Faist.



TOP: Mechanical acceptance of acoustic turning vanes in an AAWT
ABOVE: The BCA is highly efficient due to its sophisticated structure

BMW Dingolfing: lower 25Hz cut-off frequency

Faist developed two acoustic test rooms with room volumes of 1,040m³ and 273m³ for the plant in Dingolfing, Germany, where BMW manufactures the 5, 6, and 7 Series models. The requirements of the customer were very demanding. Among other things, a cut-off frequency of 25Hz was desired. In order to balance cost and benefit, BMW allowed an additional 1.5dB tolerance for the frequencies below 80Hz. The remaining frequency range was in strict accordance with ISO 3745. If using a conventional technology, wedge absorbers with a length of 3.40m would have been necessary. Using the BCA technology, however, a construction depth of 0.35m was sufficient, providing considerable space, material and therefore cost savings. Proof that the requirements of BMW were met was provided by the acceptance measurements that were carried out by acoustic specialist Müller BBM.

The larger test room is mainly used for interior measurements. It is equipped with a four-wheel drive dynamometer and a cooling air system that simulates the air flow up to 110km/h.

FAW Changchun: chamber for simulated pass-by testing

First Automobile Works (FAW), one of the biggest car manufacturers in China and production partner of Volkswagen since 1990, uses a four-wheel drive roller test stand in its development center in Changchun, which was mainly designed for acoustic measurements of accelerated pass-by testing according to ISO 362. The dimensions of the test room are 25.4 x 20.8 x 6.5m. A second anechoic room is used for powertrain NVH testing. Both rooms were designed by the acoustic experts at Faist according to the wishes of the user, and realized using BCA technology. Before that, measurement technicians and purchasers informed themselves about this sound absorption technology at their partner Volkswagen AG. Faist also planned and built the acoustic measurement rooms for the VW acoustic test center in Wolfsburg, Germany, which are based on the CPA principle as well.

Faurecia: sound test room for exhausts

The French company Faurecia S.A. is one of the top 10 international automotive suppliers. The company develops and manufactures, among other things, exhaust systems and catalytic converters. In order to generate a low noise level (or, in the case of sports cars, the right 'sound') the Emissions Control Technologies business division runs an acoustic center with a test room that was planned by Faist and is equipped with BCA cladding.

Perfect for wind tunnels

The broadband compact absorbers are also ideal for application in aero-acoustic wind tunnels used for the measurement of wind noise. They require only a minimum of space and ensure that the space available can be optimally used for both aero-acoustic and aero-dynamic testing with high flow speeds. Faist has experience in this field of testing technology – both in project management and in the installation of suitable sound insulation measures in wind tunnels, for example fan discharge silencers, turning vane silencers, sound absorbing treatment of the air-line and BCA cladding in the plenum. ‹