Advertising feature

BASF
We create chemistry

Towards the sound of silence

Unwanted noise is a scourge of modern life. But an extraordinary material from BASF's research labs is restoring a bit of peace

The impact of noise can be profound. Many office workers believe poor acoustics undermine their ability to do their jobs. And in 2005, researchers found that long-term exposure to noise at home or at work significantly increases heart attack risk.

This problem is set to get worse as the number of people living in cities increases. Today, around half the global population lives in cities and the UN believes that will reach two-thirds by 2050. The types of noise society is generating is changing too. It's easy to imagine that processes such as urbanisation will increase our exposure to unwanted sound. But researchers at the German chemicals giant BASF beg to differ. The ability to absorb sound is an engineering challenge that the company has long held dear. And it has developed a range of sound absorbing materials that can do the job.

BASF has a long history of innovation. The company was set up more than 150 years ago in Mannheim, Germany, to produce chemicals for the dye industry. Today it has annual global sales of €58 billion and employs more than 110,000 people.

Its expertise in sound insulation began with a serendipitous discovery. During the 1979 oil crisis, a team at BASF's R&D centre in Ludwigshafen began looking for thermal insulators that would cut energy use. In the process, they discovered a material which turned out to have sound absorbing properties too.

This material is made from the chemicals melamine and formaldehyde which usually react to form a hard plastic. But BASF's chemists added a "blowing agent" that turns to gas and creates bubbles inside the polymer.

This process usually forms closed spheres of gas within the resulting foam. In this case, BASF's chemists allowed the bubbles to grow until neighbouring bubbles began to combine. The result was an open cell structure with cavities measuring between 50 and 150 micrometres in diameter, bound by slender polymer strands. The company called this material Basotect® and it has some interesting properties.

As well as being a thermal insulator, it has the remarkable ability to turn sound into heat. The mechanism is simple. Sound waves are better able to enter its open cell structure than a closed cell. Inside the material, the waves set the polymer strands vibrating, heating them up. This heat then radiates away (see diagram).

By contrast, the poor acoustics in offices, sports venues and bars usually results from sound waves reflecting off hard materials such as glass, concrete or metal. Even foams with a closed cell structure reflect a fair bit of sound.

Basotect® is most effective at damping sound waves in the 500Hz to 4,000Hz frequency range — with a wavelength of approximately 70 cm to 10 cm. This corresponds closely to the frequencies of human speech and to the frequencies our hearing is most sensitive to.

The applications are many. Designers and architects have used Basotect® to improve acoustics in sports centres, theatres, restaurants, music studios, hotels and offices. Basotect® helped improve the sound quality in Beijing's swimming stadium built for the 2008 Olympics. The Solomon R. Guggenheim Museum in New York utilized it to create an immersive installation called *PSAD Synthetic Desert III* by artist Doug Wheeler where visitors can escape the sounds of the city – it runs until 2 August.

The material is easy to retrofit. "Acoustics is often forgotten when rooms and other spaces are being designed," says Peter Wolf, global marketing director for Basotect® at BASF. "Correcting such problems is where our strength lies." BASF says customers report sound reductions of up to 45 decibels relative to background noise of 50 to 60 decibels.

The material is also light, easily moulded and highly flame and heat resistant. It maintains its structure at temperatures up to 240°C. As a result, it is also widely used in the transport sector where resistance to engine heat is important.

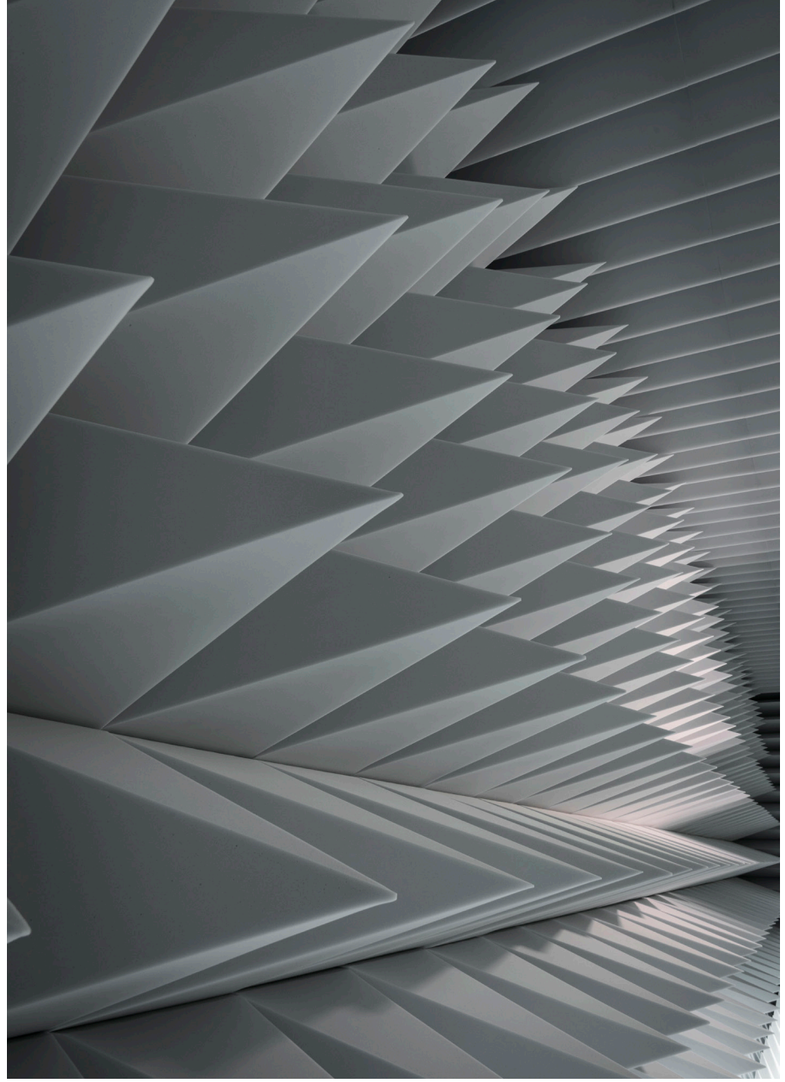
Car designers use it to absorb engine sounds and transmission noise. Passengers on a wide range of buses, trains, aeroplanes and even yachts have Basotect® to thank for the relative peace and quiet of their journeys.

And BASF researchers hope to make the material even better. Their current challenge is to make it not just flame-retardant but non-flammable. Success could allow the foam to be used in components that must comply with more stringent standards such as those for underground trains and high rise buildings.

There are other challenges too in the changing soundscape of city life. For example, engine noise is almost entirely absent in electric cars.

This looks set to reveal new opportunities for Basotect®. "The noise from internal combustion engines currently covers up a variety of smaller sounds generated by other moving parts," says Wolf. "Our understanding of the acoustics of electric cars is still developing, however it may be that drivers will be more sensitive to these other sounds, which could create a demand for new Basotect® components."

More at: www.basotect.com



Virtually quiet

EVEN the best architectural drawings reveal little about the acoustics of a building or room. This can be a big problem if the premises are intended to house a lot of people who want to talk with each other.

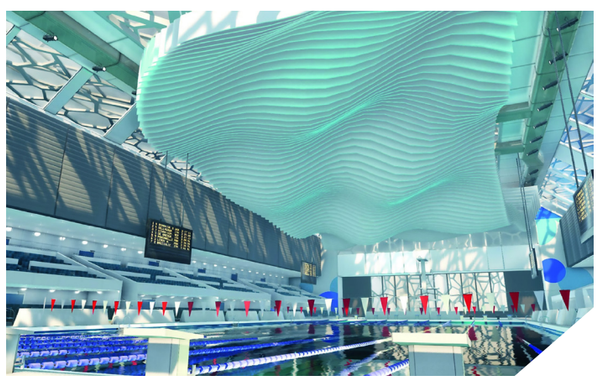
That's why BASF has developed a virtual reality audio simulation tool called Envison Mobile that allows users to hear the difference that Basotect® can make in different scenarios.

Designers and building managers using the tool wear a virtual reality headset to explore an open plan office, a restaurant, a children's nursery and a swimming pool with a joystick.

Through headphones they can hear people talking, footsteps, background music and children playing in these virtual environments with and without melamine foam sound absorbers.

The system was developed by Inreal Technologies, a company in Karlsruhe, Germany, that provides similar systems to large property developers. "It allows you to hear the acoustics of a room even years before you build it, allowing for better planning and decision-making," says Enrico Kürtös, CEO of Inreal.

BASF hopes to eventually provide tailored simulations of the acoustic benefits of Basotect® based on designs provided by individual customers.



Innovative software brings the acoustic effects of Bastotect® to life