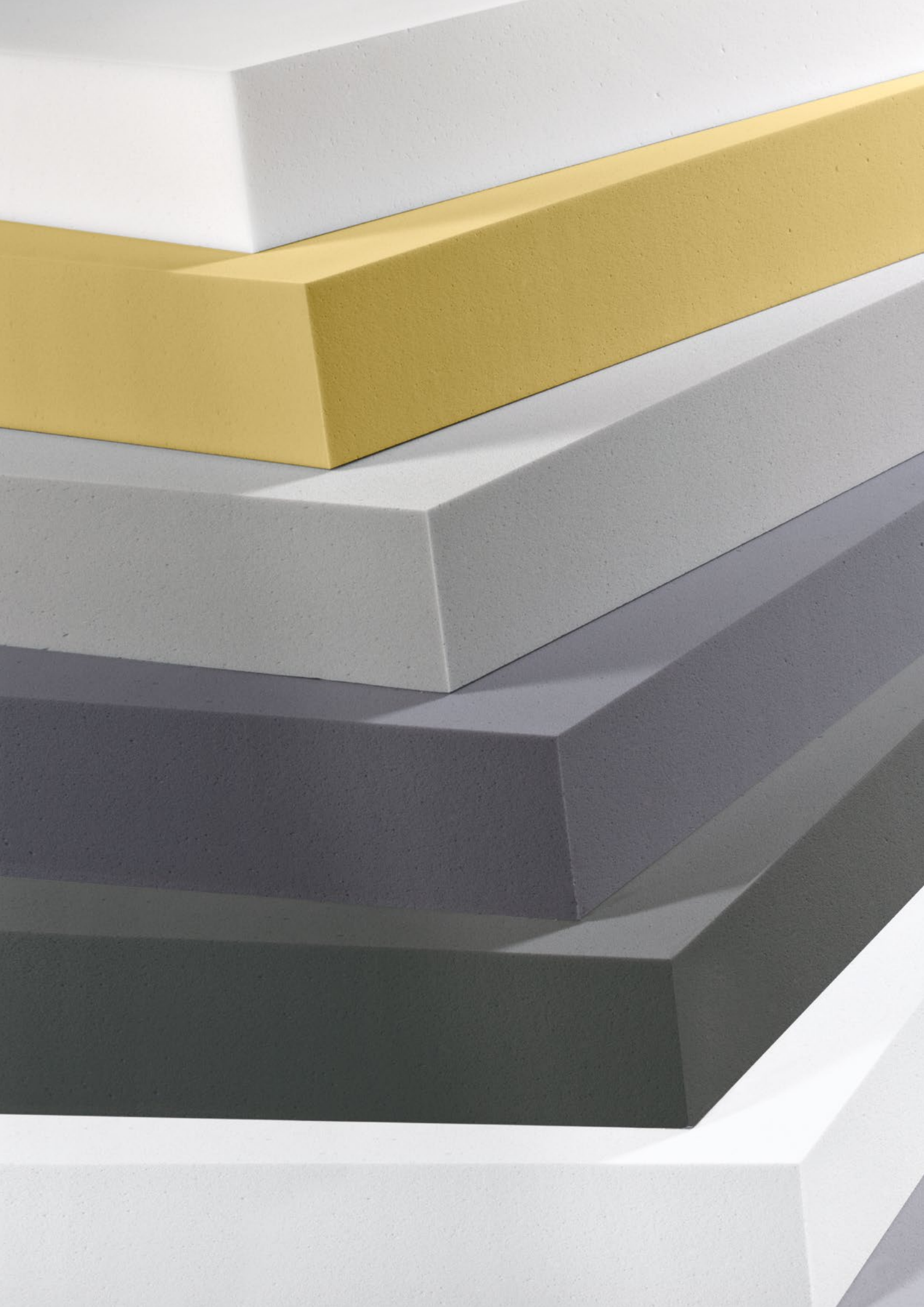


Basotect®

The versatile melamine resin foam



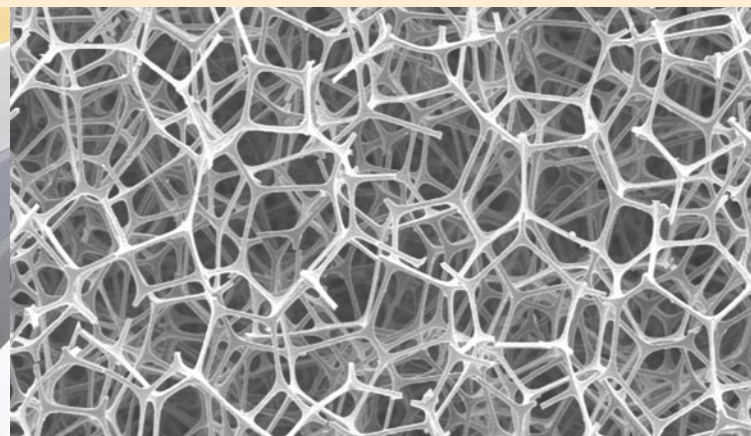
 **BASF**
We create chemistry



BASOTECT®			
	The unique property profile of Basotect®	4	04 – 06
	Properties of Basotect®	5	
	Basotect® range	6	
BASOTECT® IN CONSTRUCTION AND INDUSTRIAL APPLICATIONS			
	... to improve acoustics	7	07 – 13
	... as a decorative acoustic element	8	
	... in sport and leisure activities	9	
	... in acoustic test chambers, sound studios	9	
	... for interior structures	10	
	... in ventilation and air conditioning	11	
	... for thermal engineering	12	
	... in solar collectors	13	
BASOTECT® IN TRANSPORTATION			
	... in the automotive industry, utility vehicles and buses	14	14 – 19
	... in rail vehicles	16	
	... in ship building	17	
	... in aircraft construction	18	
	... in aerospace	19	
BASOTECT® IN CONSUMER APPLICATIONS			
	... in cleaning applications	20	20 – 21
PROCESSING OF BASOTECT®			
	Machining	22	22 – 23
	Coating, bonding	22	
	Hydrophobing, oleophobing	22	
	Impregnating	22	
	Thermoforming	23	
	Processing notes	23	

Basotect® is a flexible, open-cell foam made from melamine resin, a thermoset polymer. Basotect®'s characteristic feature is its three-dimensional

network structure consisting of slender and thus easily flexed filaments.



The unique property profile of Basotect® ...

... resulting from the basic melamine resin:

- Flame resistance (without the addition of flame retardants)
- High temperature resistance
- Constant physical properties over a wide temperature range
- Abrasiveness

... resulting from the open-cell foam structure:

- High sound absorption capacity
- Low weight
- Good thermal insulation properties
- Flexibility at very low temperature

These properties give rise to an extensive range of application possibilities. A Basotect® grade with optimized properties is available for each market segment.

Properties of Basotect®

Sound absorption

Basotect®'s open-cell surface guarantees that sound waves are not reflected but penetrate the cell structure unhindered. The sound energy is reduced in the cell structure, giving Basotect® an excellent sound absorption capacity. At low frequencies, improved sound absorption can be achieved, for example by adding layers of a heavier material.

Fire resistance

Basotect® meets the most important international fire safety standards. Basotect®'s long-term resistance to high temperatures and excellent fire characteristics are based on the melamine resin used. The high nitrogen content of the resin is responsible for the flame-resistant property of the foam without the need to use flame retardants. Basotect® is a thermoset, and thus, in the event of a fire, the material does not melt or produce burning droplets when it comes into contact with flames. The foam simply chars and produces a small amount of smoke, and there is no afterglow, making Basotect® particularly suitable for applications with high fire safety requirements. In tests on the fire characteristics required to meet national and international standards, Basotect® achieves the highest classification possible for organic materials.

Light weight

Basotect®'s open-cell foam structure contributes to its low density of 9 g/l. The light weight grade, Basotect® UL, weighs even 30% less, fulfilling the rising demand of lower weight and emissions in, for example, aircraft construction.

Thermal insulation

Basotect® offers good thermal insulation that is reliable even at high temperatures over a prolonged period. It provides low thermal conductivity of less than $0.035 \text{ W}/(\text{m} \cdot \text{K})$, so energy losses can be reduced in, for example, hot water tanks and solar water heaters. Another advantage over conventional insulation materials is Basotect®'s excellent resistance to temperatures of up to 240°C and its flame retardance (in Germany: B1 according to DIN 4102).

Constant physical properties over a wide temperature range

Basotect® retains its properties over a wide temperature range. It keeps its flexibility even at -200°C and is also suitable for application temperatures up to 240°C . This enables a broad variety of applications, such as insulation of liquefied natural gas (LNG) tanks or soundproofing of engine compartments.

Resistance to chemicals

Thanks to Basotect®'s highly cross-linked structure, it is resistant to many organic solvents. When it comes to acids and alkalis, the resistance has to be checked in actual application conditions since the temperature, the exposure time and the concentration all have a great deal of influence on the stability of the foam.

Abrasiveness

Unlike other foams, Basotect® is as hard as glass, but the fine cell structure provides the product's flexibility. Due to its abrasive properties, Basotect® works like very soft sandpaper. When moistened with water, it slides easily and rubs the dirt off the surface.

Environment & Health

Basotect® is compliant with the RoHS directive and is not subject to labeling requirements under the German hazardous material regulations. In addition, some Basotect® grades are certified to the Oeko-Tex® Standard 100.

Due to its low density, Basotect® can contribute to a reduction of the weight of insulation components, thus contributing to energy savings and a reduction in emissions in transportation applications.

Thanks to its sound and thermal insulation properties, Basotect® can contribute to efficient energy utilization and improve the well-being of people in buildings and vehicles by lowering the noise level.

Basotect® range – an overview

For every use, there is a proper grade of Basotect®

Basotect® is supplied in the form of blocks with standard dimensions of 2500 x 1250 x 500 mm to processors that produce shaped parts for diverse applications, e. g., by cutting, stamping and pressing.

The different Basotect® grades cater to a variety of applications – for each application the Basotect® portfolio offers a grade with an optimized property profile.



The Basotect® range includes six different grades.

- **Basotect® B** is a high performance material especially designed for visible interior architectural applications where it takes advantage of its full potential. The flame resistant foam combines excellent sound absorption and high light reflection. In addition to the proven characteristics of Basotect® such as flame retardancy and simple, mineral fiber-free fabrication, the new material offers a wide range of design possibilities for interior decorators and designers.
- The light gray product variant is called **Basotect® G+** and is equal to the white Basotect® B regarding thermal conductivity, flame retardancy and simple, mineral fiber-free fabrication. Its coloration makes it less sensitive to soiling, which also makes Basotect® G+ especially suitable for many construction and industrial applications.
- Special technical applications where thermoforming is needed can be realized with **Basotect® TG**. This dark grey Basotect® grade can be thermoformed without the need of additional impregnation steps and is the material of choice in automotive construction.
- The gray **Basotect® UF** is characterized by a very high elasticity and by improved fire properties, which makes this even more elastic version of Basotect® suitable for the construction and rail transportation industry, providing much greater freedom of processing and design.
- **Basotect® UL** has an impressive ultralight density and is thus especially well-suited for all applications that call for an exceptionally low weight, for example, in aviation and aerospace.
- **Basotect® W** can be used for numerous consumer applications, especially for cleaning products. This grade has also been tested to Japanese Law 112, one of the most stringent tests for formaldehyde in the world. In addition, it meets the requirements of Oeko-Tex® Standard 100 in product class I.

Basotect® in construction and industrial applications ...

Its high sound absorption capacity and safe fire characteristics make Basotect® B, G+ and UF ideal for use as sound absorption in buildings. They provide practically unlimited design freedom. Decorative acoustic panels, suspended baffles or metal panel ceilings backed with Basotect® provide a tangible and measurable improvement in interior acoustics. In industrial applications, Basotect® can also serve as thermal and acoustic insulation, e. g. in HVAC* applications.

Key benefits:

- Comfortable room acoustics
- Fire safety
- Easy installation
- High design freedom
- Energy efficiency
- No mineral or glass fibers



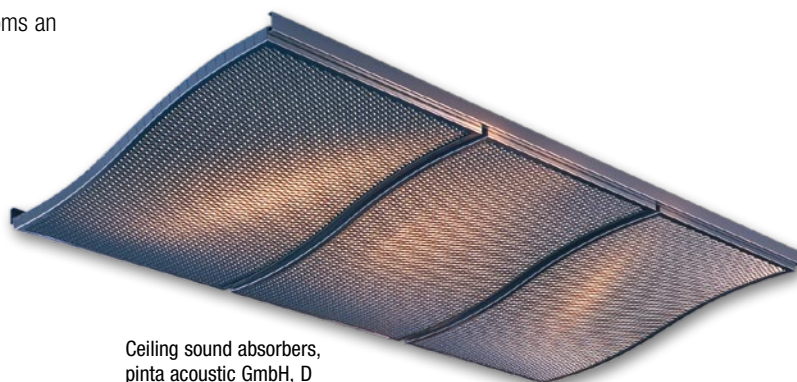
Hotel Barceló in Barcelona, Tecno-Spuma, E

... to improve acoustics

Open-cell sound absorbers made of Basotect® B or G+ improve the acoustics of rooms where good understanding of speech and audibility are especially important. Ceiling sound absorbers are finding ever greater acceptance as an alternative to conventional ceiling systems. When constructed in a sandwich structure with a Basotect® core and decorative cover layers, these sound absorbers create a pleasant acoustic and visual environment. A sandwich composite made up of Basotect® B or G+ with gypsum plasterboard, chipboard or plywood board and metal or plastic cover layers creates acoustically effective partition walls and room dividers.

Due to their low weight, Basotect® B and G+ allow the creation of large-surface elements that seem to be free-floating, giving rooms an attractive appearance.

Work areas exposed to high levels of noise (heavy machinery and metal-working plants, among others) can be inexpensively restored to acoustic tolerability by retrofitting them with lightweight baffle absorbers. Meeting rooms, offices and hotel foyers can be acoustically upgraded just as effectively and attractively using Basotect®. The low intrinsic weight of Basotect® baffles allows for simple methods of attachment during installation so that additional structural engineering calculations on the ceiling are usually not needed.



Ceiling sound absorbers, pinta acoustic GmbH, D

* HVAC = heating, ventilation, air conditioning



WAVE acoustic modules made of Basotect®, Späh, D

Application example:

The Betty T. Ferguson recreation Center in Florida, USA, is using BASF's melamine foam Basotect® to enhance acoustics for swimmers and visitors. The unique sculpture "Splash!" features colorful cylinders made with Basotect®, which line the ceiling in the swimming center.

The new sculpture "Splash!" addresses a common problem associated with most indoor pools: a high level of background noise caused by reflected sound waves. For the recreation center in Florida, Artist Xavier Cortada envisioned a design composed of scattered pool noodles that would resemble a splash of water on the ceiling. He realized his idea by designing the sculpture with colorful Basotect®-based cylinders.



"Splash!" sculpture made with Basotect® in indoor swimming center, USA

... as a decorative acoustic element

Open-cell sound absorbers made of Basotect® B and G+ improve the acoustics of rooms where good understanding of speech and audibility are especially important.

The foam can be processed into a wide variety of shapes and colors, offering a high degree of design freedom for designers and architects. Basotect® B in particular opens a wide range of design possibilities. Not only can the foamed material be formed into any desirable shape but it can also be flocked, printed and laminated. Professional spraying and printing with specialty coatings and inks can retain the foam's very good sound absorption capacity while producing ultra-sharp images with a velvety smooth surface.

Basotect® is therefore not only functional; using Basotect® also allows creative expression in all kinds of spaces both acoustically and visually. Colored Basotect® offers new design options in sound insulation.

Basotect® in construction and industrial applications ...



Basotect® covered with blue fabric in Indian prayer hall



Colored conical absorber elements, Texas, F

... in sport and leisure activities

Ceiling systems are also used to reduce noise in sports venues, ice rinks and swimming pools. This is where the special product advantages of Basotect® come to the forefront: enabling simple fastening with extremely thin cable structures, good sound absorption, low weight and high fire safety. The combination of sound absorption with flame resistance also make this foam ideal for use in shooting ranges.

... in acoustic test chambers, sound studios

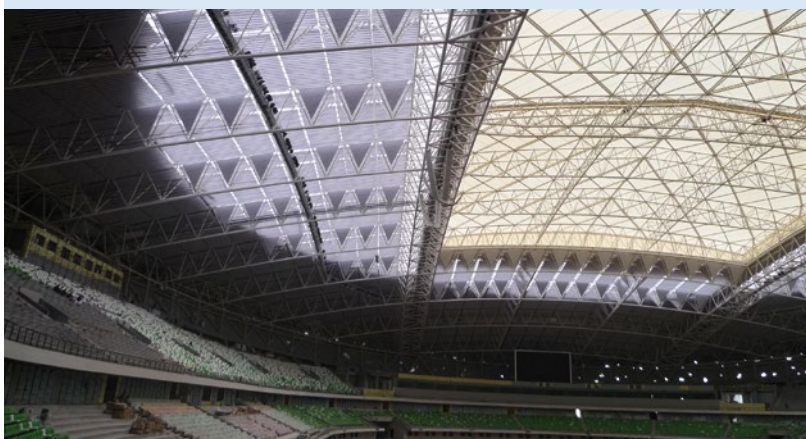
Basotect®'s high sound absorption capacity and fire safety make this product suitable for use in acoustic test chambers, engine test benches, wind tunnels, sound studios and movie theaters.

Highly developed composite sheet resonators (CSR) made of Basotect® constitute a modern form of resonance-like oscillating systems. These allow the soundproofing of test chambers in a way that is tailor-made to the customer's specifications.

Application example:

More than 30,000 square meters of ceiling baffles made from Basotect® foam have been installed on the retractable roof of the Dongsheng National Fitness Center Stadium in the city of Ordos, northern China. Thanks to its open cell and fine foam structure, Basotect® effectively absorbs reverberations caused by multiple reflections of sounds on hard surfaces.

This provides the audience with a more comfortable acoustic experience. The complex construction required not only an effective sound insulation but also a lightweight solution. The 50-meter high and 320-meter wide construction has a seating capacity of 50,000 and thus is China's largest stadium with a retractable roof.



Ceiling baffles at China's largest retractable sports stadium roof

Basotect® in construction and industrial applications ...



Full Integrated, thermally active ceiling Ceiltec® with strip absorbers made of Basotect®, Innogration GmbH, D

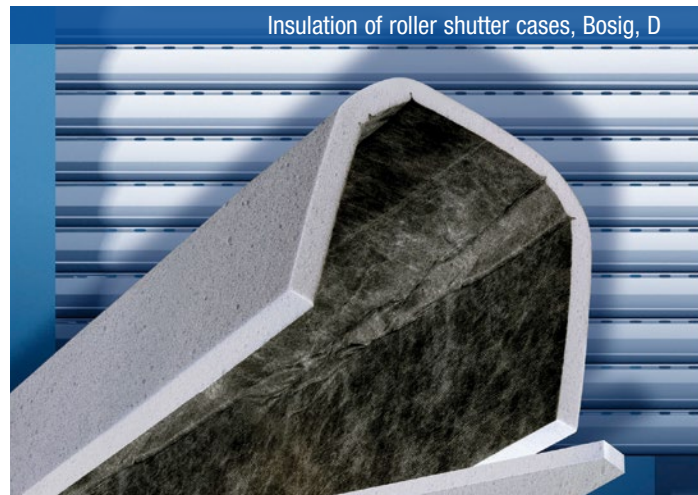
... for interior structures

Due to the foam's low rigidity, Basotect® is suitable for sound insulation in combination with layers of heavier materials. Composite elements made up of gypsum plasterboard and Basotect® in the form of cladding for interior structures provide a high degree of acoustic comfort.

Another area of application in the construction sector is the lining of the interior of roller shutter cases with Basotect®. This serves as thermal insulation and reduces the noise that can be generated when a roller shutter is operated. Basotect® also provides soundproofing against external noise.

Thermally active ceilings can also be realized without negatively affecting acoustics. This is demonstrated by the application of Basotect® in multifunctional cooling and heating ceilings for offices and administrative buildings where strip absorbers made of Basotect®. With these Basotect® strips, good sound absorption, resulting in low reverberation times, can be achieved at ceiling coverage of as little as 15%.

Insulation of roller shutter cases, Bosig, D





Silent fresh air with Zehnder ComfoSilence, Zehnder, CH

... in ventilation and air conditioning

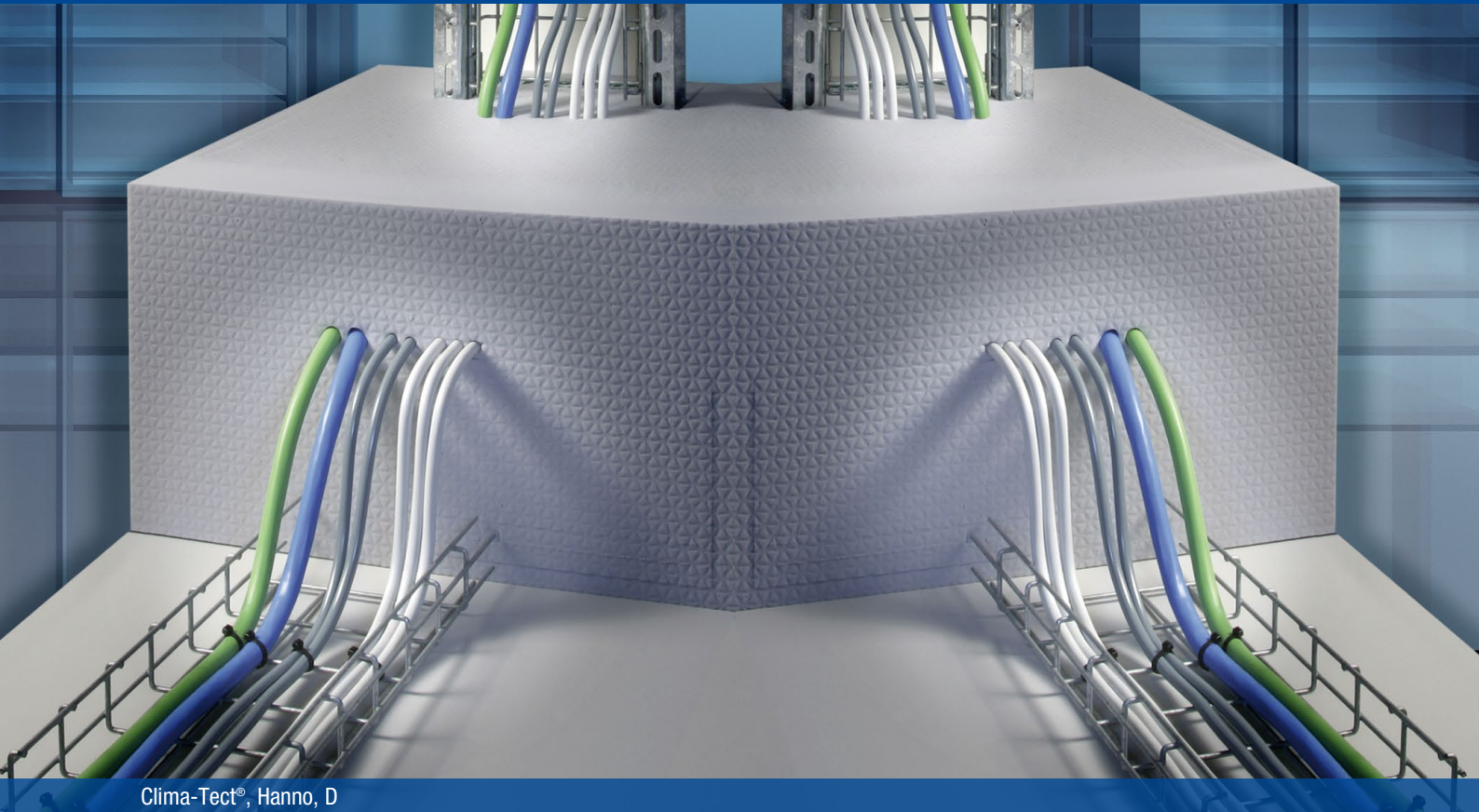
Outstanding sound absorption and fire safety properties are the most important advantages of Basotect® for its use in silencers for air conditioning units and ventilation systems. The interior walls of fan housings are also lined with Basotect® to reduce noise levels.

The flow-optimized design and the resulting lower pressure drop mean that outstanding sound absorption can be achieved with Basotect® in ventilation technology components such as mufflers, air diffuser and fans etc. Further characteristics such as low weight, flame retardancy, high temperature stability as well as uncomplicated processing and assembly are increasingly leading to the use of Basotect® in HVAC* applications.

The melamine resin foam meets the hygiene-relevant requirements and is mineral and glass fiber-free, meaning that no mineral or glass fibers are released into room air.

* HVAC = heating, ventilation, air conditioning

Basotect® in construction and industrial applications ...



Clima-Tect®, Hanno, D

... for thermal engineering

Insulation for pipes can be produced from Basotect® G+ using contour cutting machinery. Even technically demanding thermal insulation projects can be successfully tackled, because Basotect® G+ can withstand very high temperatures and offer low flammability. The fact that Basotect® is not mineral or glass fiber based is a major advantage for use in clean rooms.

Additional applications of thermal engineering in buildings include the insulation of hot water tanks and equipment. System solutions based on the flexibility of Basotect® allow the application of the insulating material over the entire tank wall. In this way, the chimney effects typical of conventional half-shell insulation can be reduced, energy losses cut and fitting simplified.



Pipe jacket insulation



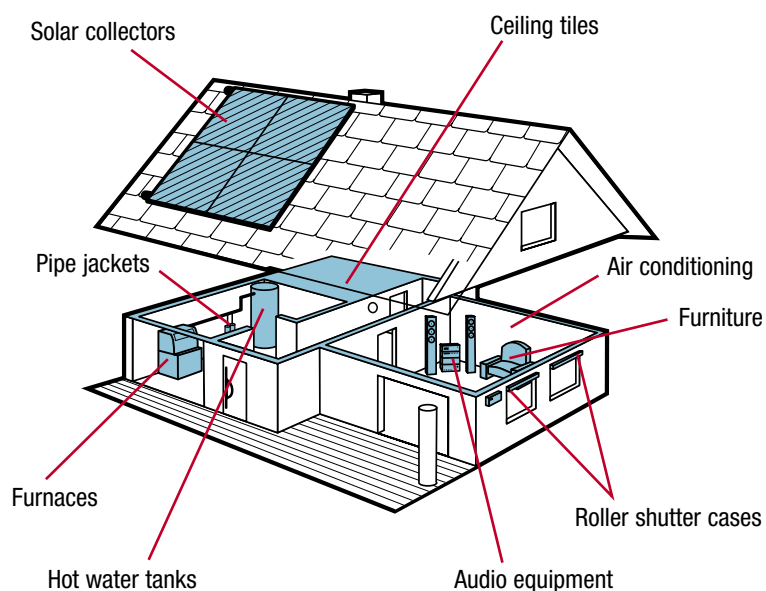
Thermal tank insulation,
Greiner PURtec, A



Thermal insulation of solar collectors, Viessmann, D

... in solar collectors

Solar collectors should absorb as much energy from sunlight as possible and reflect very little, thus low thermal conductivity and a high long-term service temperature are key factors. Basotect® provides good thermal insulation that is reliable even at high temperatures over a prolonged period. Basotect® releases virtually no volatile substances that could reduce solar absorption and therefore reduce the efficiency of the solar panel.



Basotect® in transportation ...

Basotect® can ideally fulfill the rising demand for soundproofing in the field of transportation. Thanks to its good sound absorption, very low weight and high heat resistance, Basotect® offers a wide variety of applications ranging from automotive construction to aerospace.

Key benefits:

- Less noise
- Reduced weight
- Energy efficiency
- Fire safety
- High temperature resistance



Hood liner for the Lexus LS., Photo: Toyota/BASF



Silencing in the Volkswagen EA888 engine, North America. Photo: VW/BASF

... in the automotive industry, utility vehicles and buses

Basotect® TG and G+ are used in automotive construction together with felt or plastic covers. Aside from outstanding acoustic engineering properties, Basotect®'s high heat resistance, high fire safety, low fogging behavior, chemical resistance and, last but not least, low weight are especially valued by the automotive industry.

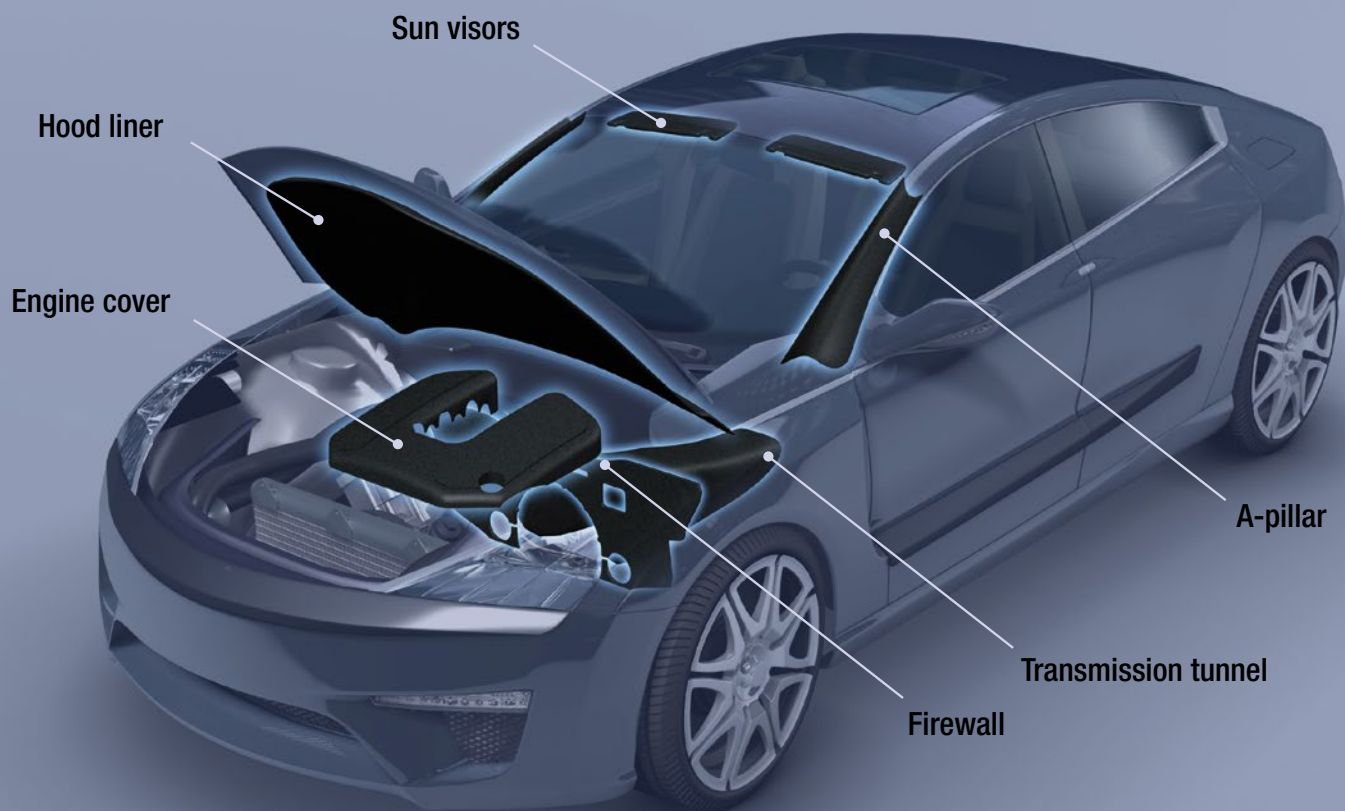
Laminated absorber elements are suitable for installation under the hood as well as for heat shields in front of automobiles' firewalls and in transmission tunnels. Due to the high flexural strength, covers made of Basotect® allow the production of engine hoods that offer optimized protection to pedestrians. In this way, the more stringent requirements that are now necessary in terms of pedestrian protection can be met.

Due to this exceptional combination of properties, Basotect® is used for sound insulation in engine covers. Other applications in the automotive industry include heat shields made of Basotect® combined with aluminum foil.

Lining motor coverings with Basotect® foam allows car manufacturers to solve many problems. It offers outstanding silencing, flame retardancy and weight saving in those areas around the engine with the highest level of heat build-up.



Engine covers, Benien, D



Basotect® in cars

Due to its resilience, low weight and excellent acoustic properties, Basotect® is also used for filling hollow spaces in vehicles, for example, as filling for the A-, B- and C-pillars.

The acoustic properties of inserts made of Basotect® account for a reduction in noise levels in the driver's cab in trucks and agricultural machinery. Such inserts thus make an important contribution to protecting the health of occupants and to increased road safety.

Through optimal soundproofing of the engine compartment and of the passenger area of buses, Basotect® G+ ensures the comfort that passengers have come to expect.

Soundproofing of the engine compartment and passenger area in buses



Basotect® in transportation ...



Ceiling insulation with Basotect®

Thermal insulation and sound absorption in the ceiling area of subway cars in Montreal, Canada. Photo: Bombardier, Inc.

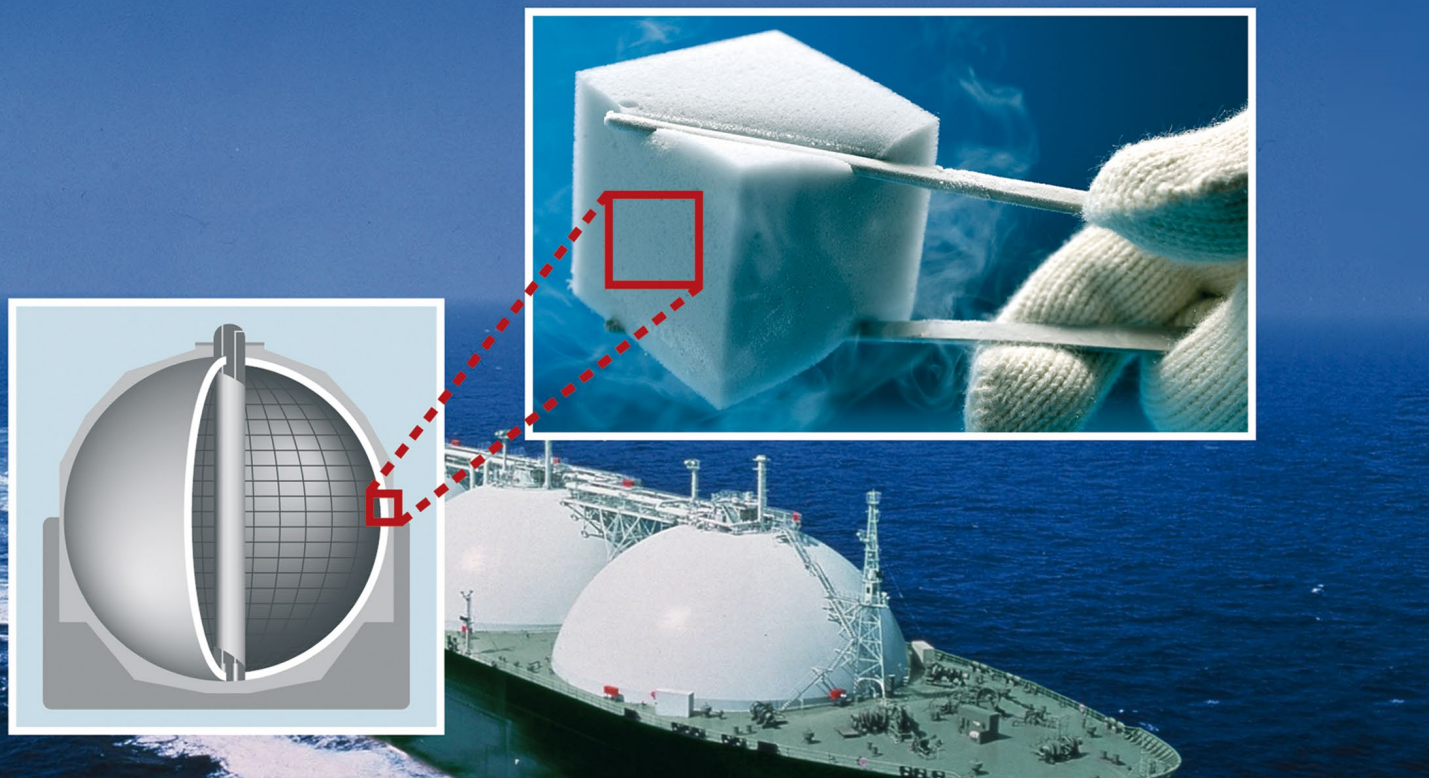


Internal insulation of rail vehicles

... in rail vehicles

The excellent acoustic properties, safe fire characteristics and low weight of Basotect® UF and G+ make them ideal for use in rail car wall and ceiling systems and for laminated interior fittings with decorative designs. Owing to the high elasticity and ease of processing of this product, complex installation work can be carried out cost-effectively. When it comes to applications in walls and ceilings, the high level of thermal insulation brought about by the low thermal conductivity is another strong argument in favor of using Basotect®. In addition, the operating costs for climate-controlled passenger cars, for instance, can be drastically reduced. Basotect® meets the required fire safety standards for rail vehicles – the UF grade already satisfies the highest level of the new European Union fire safety standards (HL 3 acc. EN 45545-2).

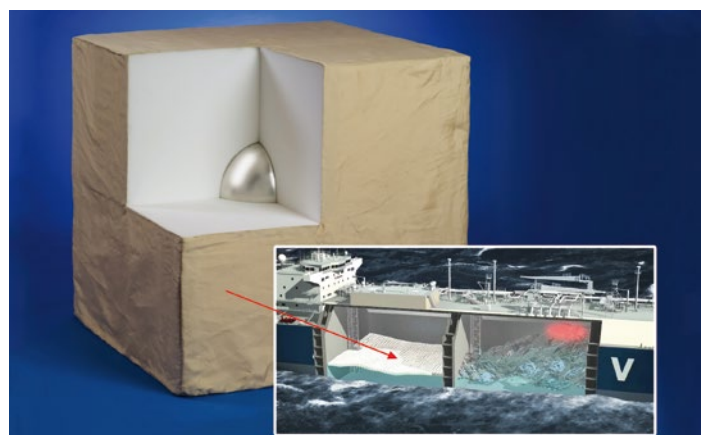
Due to the product's low weight in comparison to other insulating materials, Basotect® also contributes to increasing the overall energy efficiency of the rail vehicle. Additionally, the weight reduction in the wall and ceiling areas lowers the center of gravity of the cars and thus increases safety when negotiating curves. This is of particular relevance for narrow-gauge railroads.



Insulation of cryogenic liquefied gas on tankers

... in ship building

Basotect® G+ is employed as an acoustic system solution in ships. The good low-temperature stability of Basotect® means that it is also well-suited to insulate cryogenic liquefied gas on tankers. The product's elasticity and heat insulating capacity are retained even at -200°C.



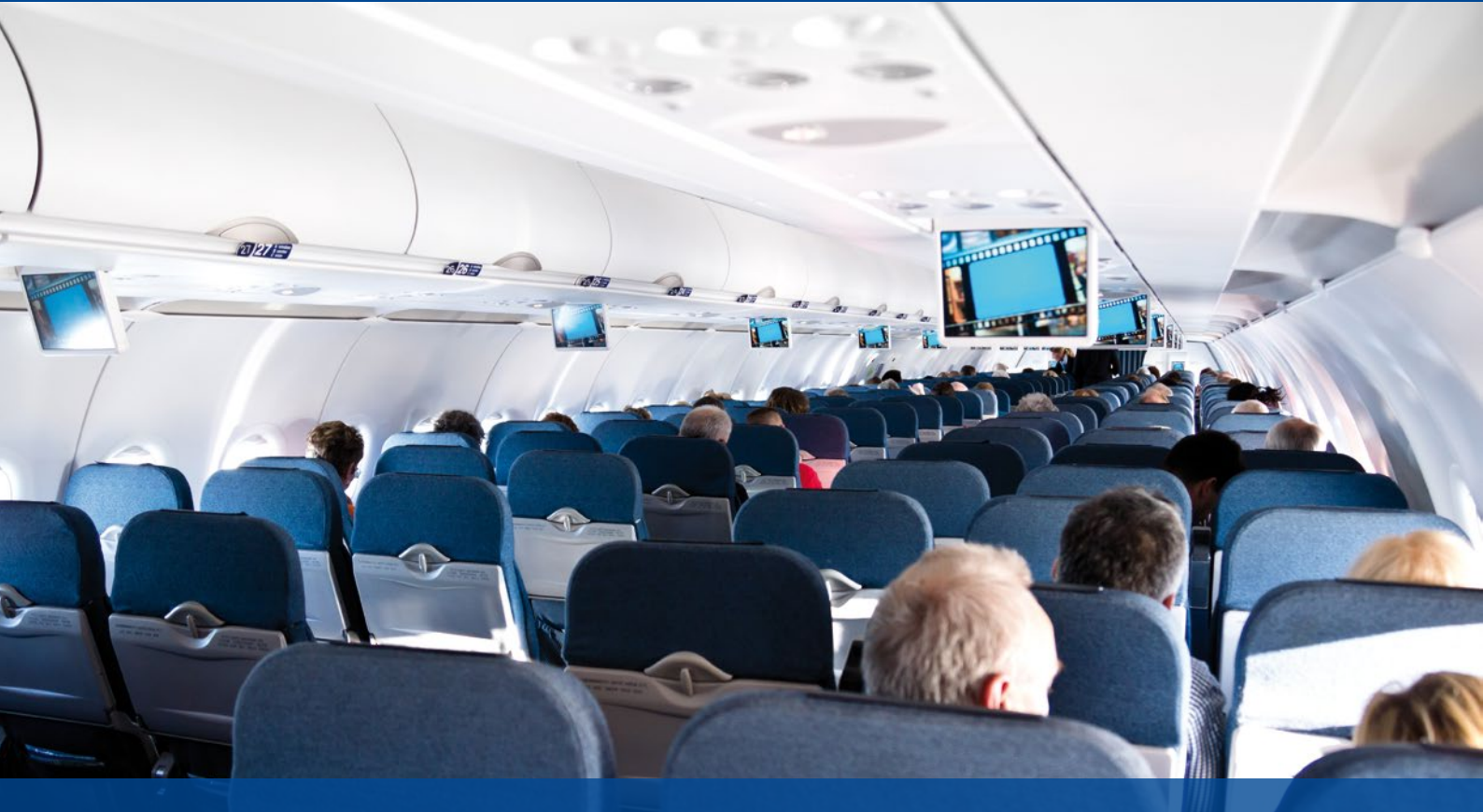
Basotect® cube for anti-sloshing. Photo: BASF/Samsung Heavy Industries

Application example:

BASF and Samsung Heavy Industries have developed a new solution to prevent the sloshing of liquefied gas during its transport in tankers. It is a kind of blanket consisting of cubes with a volume of one cubic meter, made of Basotect®. The open-cell foam stays

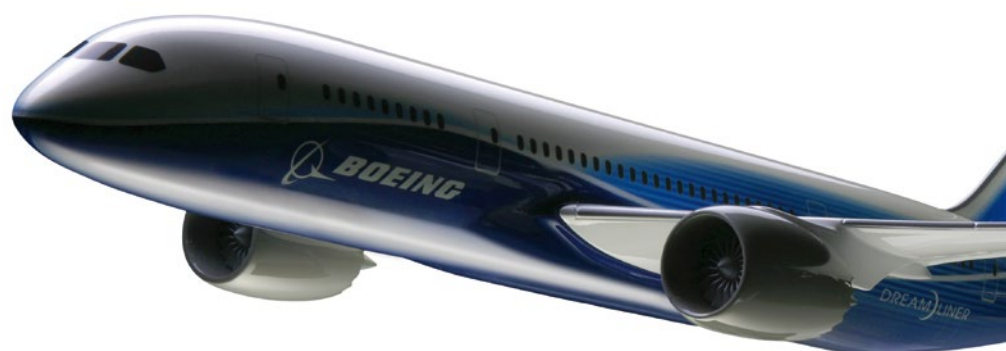
flexible even under cryogenic conditions: The ship's steel tanks must remain cooled to minus 162 degrees Celsius to keep the gas liquid. The anti-sloshing solution prevents damages and allows for flexible load levels, which reduces the number of no-load journeys.

Basotect® in transportation ...



... in aircraft construction

Basotect® UL was specially developed for insulating cabins and the ductwork in aircraft. It weighs just six grams per liter, which makes Basotect® UL 30 percent lighter than conventional Basotect®. This means it is possible to fulfill the rising demands on noise, safety and increasingly lower weight in aircraft construction; at the same time, Basotect® UL meets the stringent fire safety standards set by the aviation authorities.



Internal insulation of the Boeing 787



Payload cladding of the Ariane 5 launcher rocket. Photo: ESA/CNES/Arianespace 2006

... in aerospace

The advantages of the low density and sound absorption capacity of Basotect® also permit its use in more and more system applications in the aerospace industry.

Basotect® is used for cladding the payload section in the nose cone. This protects the sensitive satellites from the high acoustic pressure exerted on the rocket during the lift-off. Key properties for the use of Basotect® in space rockets are its good sound absorption capacity, high flexibility, low density, and easy processability.



Basotect® in consumer applications ...

The abrasive properties of Basotect® W make it ideal for use in cleaning applications. Its good cleaning action and fine structure are clear advantages for the consumer.

Key benefits:

- Easy cleaning (eraser effect)
- Oeko-tex® certified (product class I)



Basotect® W, the optimal grade for cleaning applications

... in cleaning applications

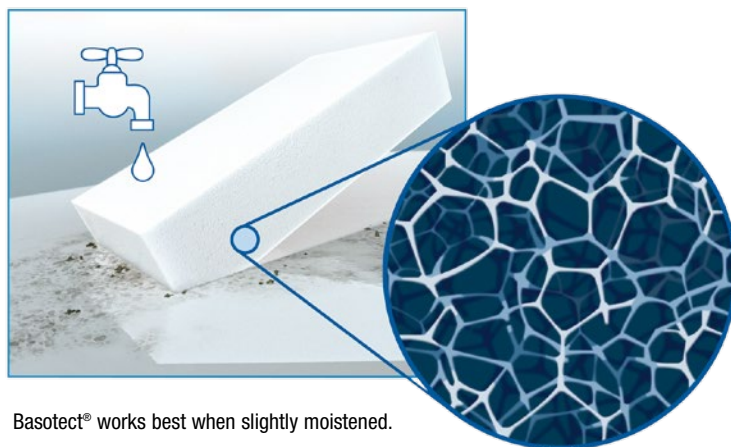
Basotect® W offers a completely new cleaning medium, both inside and outside the house. Heavy dirt on smooth, hard surfaces such as ceramic and glass tiles, stove tops, counter tops, walls, trim and doors, can be thoroughly erased with the white grade of Basotect®. Basotect® W can also be used on leather seats and hubcaps in the automotive realm. Basotect® W acts in a manner that differs from that of other cleaning products available on the market.

It simply rubs off the dirt. The abrasive foam works like a very soft sandpaper since, unlike other foams, Basotect® is as hard as glass, but the fine cell structure provides the product's flexibility. When Basotect® is moistened, it slides easily and rubs the dirt off the surface.



Effective cleaning power on dirty floors

Basotect® W meets the currently applicable human-ecological requirements of the Oeko-Tex® Standard 100 in product class I for textile products with direct skin contact in especially sensitive applications.



Basotect® works best when slightly moistened.

Processing of Basotect®



Coating of Basotect® panels



Basotect® shaped parts, Cellofoam, D

Machining

Basotect® is supplied in the form of foam blocks to processors for further processing. This is where the product is cut into multi-dimensional shapes by slitting, milling, sawing and stamping to form the required contour. The elastic resilience of the Basotect® panels also allows the use of shaped cutting.

Coating, bonding

Surface coatings for coloring purposes or for improving the mechanical properties can easily be applied to the fine-cell Basotect® surface by spraying, for example.

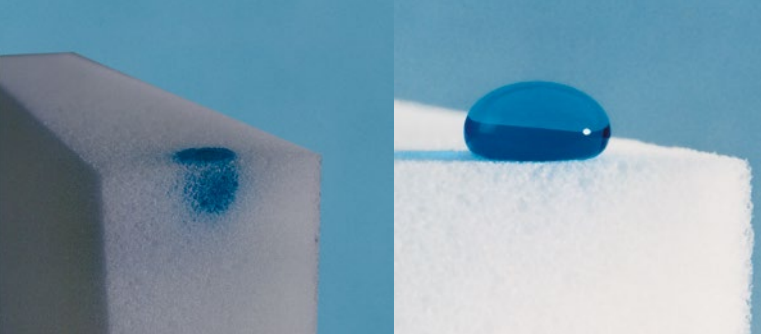
By the same token, a very wide range of adhesives commonly available on the market can be used for bonding Basotect® sections. Adhesives containing solvents as well as reactive resins can also be used without any problem. This means that numerous material combinations are possible. It should be kept in mind, however, that processing with adhesives and dyes changes the flammability properties of the components.

Hydrophobing, oleophobic

Basotect® is an open-cell foam with highly hydrophilic and oleophilic properties. Cut sections of Basotect® can be rendered water-repellent by impregnating them in silicon emulsions. Fluorocarbon resins allow hydrophobing and oleophobic in one single step. It is practical to carry out the hydrophobing and oleophobic in an impregnation process.

Impregnating

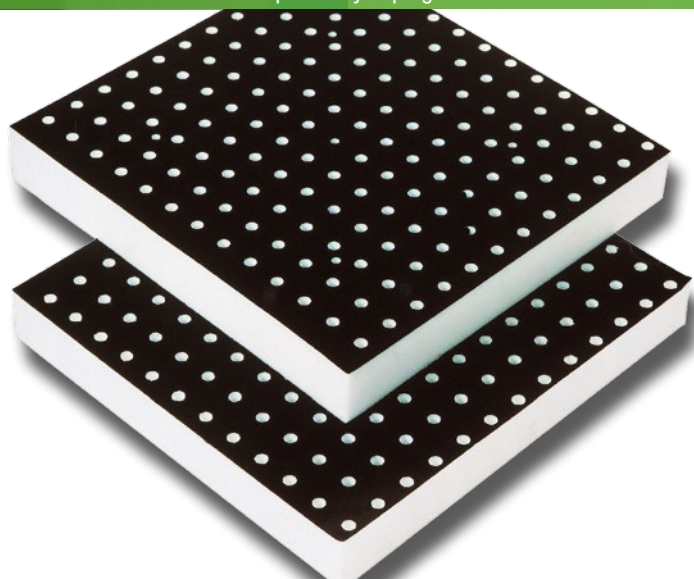
Numerous Basotect® shaped parts are produced by thermoforming. Since conventional Basotect®, a thermoset polymer, cannot be thermoformed, the product has to be impregnated with a thermally reactive adhesive liquid. This is done in post-production using so-called impregnating systems. In order to accelerate drying, the excess liquid is squeezed out by a two-roll mill after impregnation. The impregnated Basotect® can then be processed by thermoforming. With Basotect® TG, BASF also offers a ready-made grade for thermoforming without the need for impregnation.



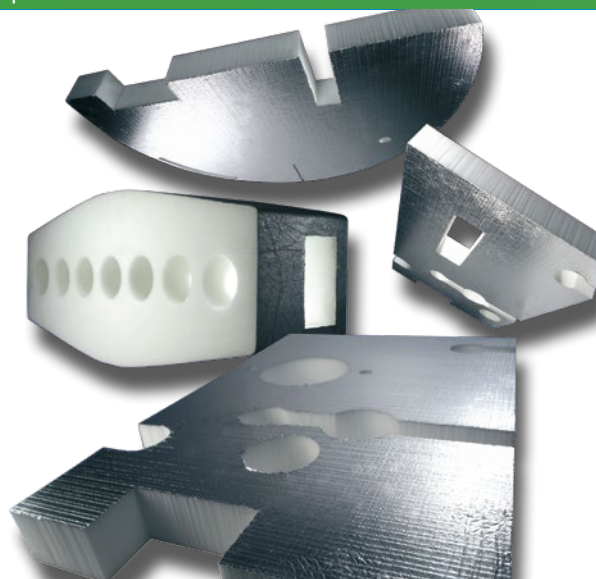
Basotect® rendered water-repellent by impregnation



Shaped part with aluminum foil and felt



Stamped Basotect® shaped part with felt



Stamped Basotect® shaped parts, ENAC, F

Thermoforming

Composite materials consisting of a Basotect® core and felt, fabric, metal and plastic laminates can be manufactured in one forming procedure. The hot-press process can also be used to emboss decorative patterns on the surface of the Basotect® panels.

BASF's research work has led to the development of a thermoformable grade of Basotect® – Basotect® TG. Sections cut from Basotect® TG can be formed at a temperature of > 200°C to produce three-dimensionally shaped components. This dispenses with the impregnation step that is needed with standard Basotect® grades in order to produce such shaped parts. This means greater cost-effectiveness in the processing steps. Along with the fact that Basotect® TG can be thermoformed without a preceding impregnation step, Basotect® TG also has the proven material properties of Basotect®.



Thermoformed Basotect® TG

Processing notes

Processing of any semifinished products, like Basotect®, by e.g. cutting or sawing can lead to dust formation. Any dust that might be produced during certain processing steps should be removed by vacuum directly at the cutting site. Wearing a dust mask during these tasks is recommended. Unlike products based on fibres, Basotect® is an open-cellular foam. Basotect® is therefore not associated with any irritating effects caused by the release of fibers, and so there is no need for additional safety measures during handling and transportation.

Due to the absorption behavior of melamine resin and the open-cell structure of the foam, the moisture content of the material changes with the ambient conditions. This is associated with changes in dimensions that occur similarly in the case of wood, concrete or clay tiles. This behavior must be taken into consideration during processing. The foam blocks, which are delivered sealed in PE film, must be unpacked and stored for several days prior to processing under atmospheric conditions corresponding to the blocks' later use.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (January 2016)

Additional information on our products, product properties and applications:

www.basotect.com
basotect@basf.com