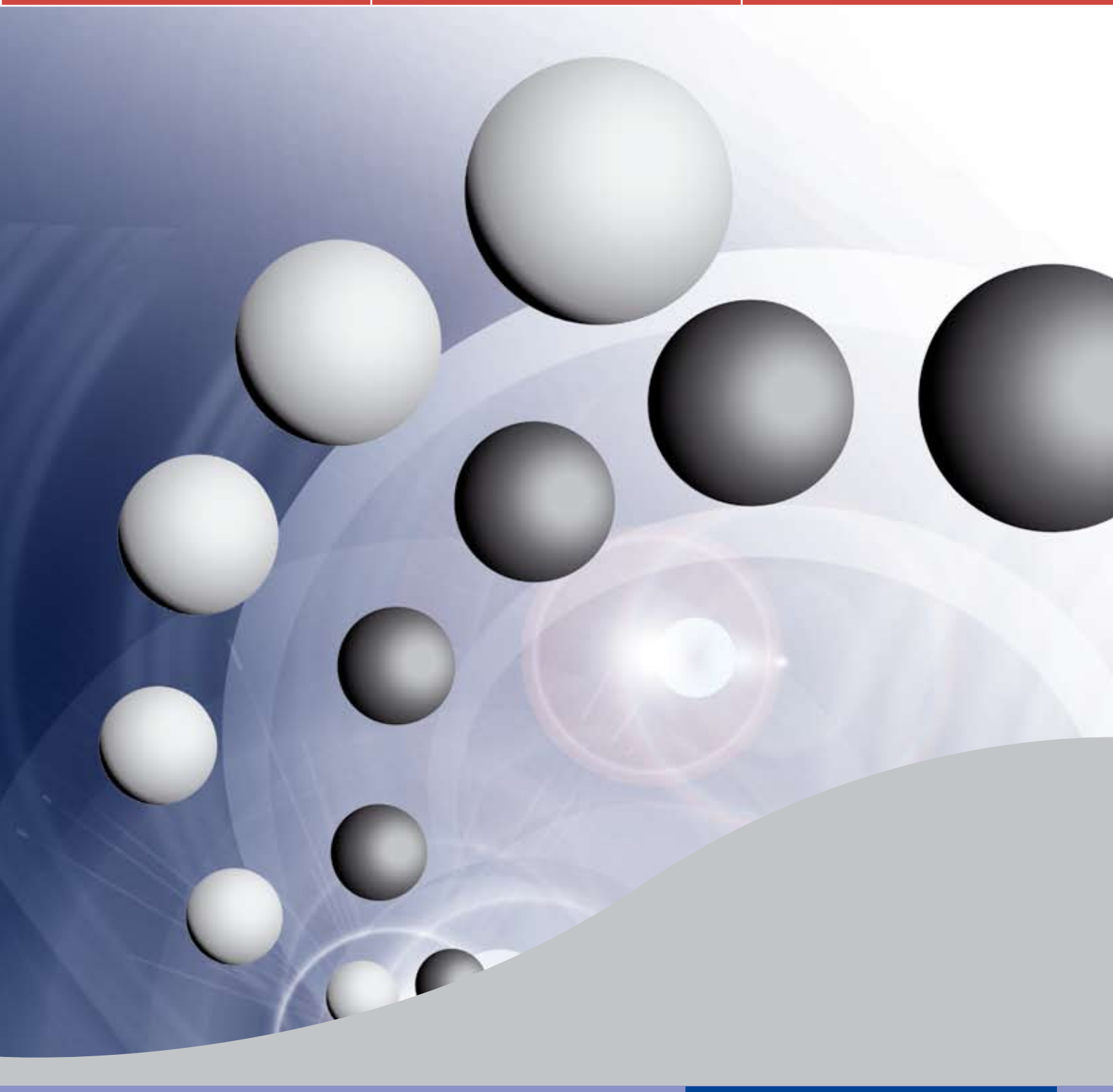
Styropor®

Neopor®

Peripor®



Insulation and packaging using strong brands

Products – Processing – Applications

BASF Plastics
key to your success

BASF
The Chemical Company

More than just a trademark: Styropor®

1952 marked the beginning of the success story of a foam that we can no longer imagine doing without in our everyday lives: Styropor®, BASF's **e**xpandable **p**oly**s**tyrene (EPS). Over the course of time, Styropor® has become synonymous with economical construction and rational, secure packaging. As ongoing research and consistent product development led to the product groups of Neopor® and Peripor®, new EPS applications have also become possible, especially in the construction sector.

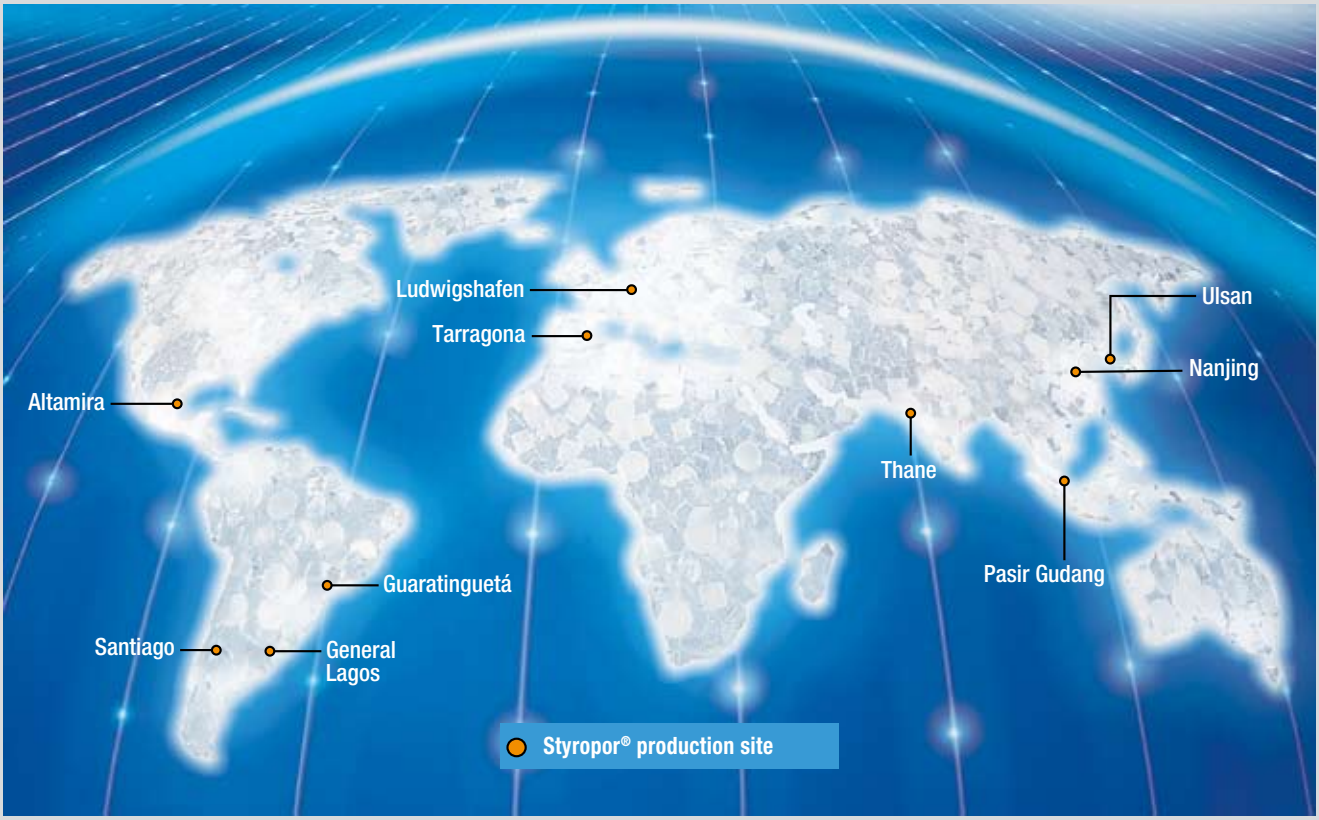
BASF will also be paying substantial attention to research, development and customer service in the future, helping the company continue to meet product and market requirements. With its 10 production sites, not to mention its sales companies in pretty much every country, BASF offers ideal market and customer proximity worldwide. Aiming to keep improving processing methods and the quality of foamed finished parts, BASF has a technically knowledgeable customer service team ready to provide advice and assistance.


„Das leichteste Schiff der Welt ist das STYROPOR-Schiffchen".

Das leichteste Schiff der Welt...

Badische Anilin & Soda Fabrik

Plastics fair in 1952:
BASF presents Styropor®



BASF's EPS expertise is available round the globe

Styropor®, Peripor®, Neopor®: inventions by BASF for successful construction and packaging solutions

Quality is our yardstick

One of the main expectations of our customers is that we maintain a constantly high quality. This is true not only of the quality of our products but also of the quality of all business processes. We consider it our obligation to meet this customer requirement and everything we do revolves around this. In order to consistently deliver high-quality products to our customers, we need comprehensive quality assurance systems in all areas.

All of our production sites, with a total annual capacity worldwide of more than 500,000 t of Styropor®, Neopor® and Peripor®, are certified in accordance with DIN ISO 9001/2.

An EPS range for numerous applications

The raw materials Styropor®, Neopor® and Peripor® are produced from styrene monomer using suspension polymerisation methods. During these processes, the blowing agent pentane and other additives are also added, creating compact, bead-shaped granulates. The granulates are separated into different sieve fractions in further process steps and various fabrication procedures are used to make them ideal for processing into high-quality foams. The product range comprises both standard and special-purpose products. Special-purpose products are products with special processing and finished part properties. This gives rise to a large number of product variants tailored to meet the requirements of processors and users.

A detailed overview of the range is enclosed with this brochure.

Product group	Important properties
Styropor® P (without flame retardant)	• **Particularly energy-saving application, short cycle times, low bulk densities, narrow bulk density distribution** • Foams suitable for direct contact with food • Foams with good heat-insulating properties
Styropor® F15 and - EF15 (with flame retardant)	• **Particularly energy-saving application, short cycle times, low bulk densities, narrow bulk density distribution** • Foams with good heat-insulating properties • Foams producible in line with material class E (EN 13501-1)
Styropor® F95 (with flame retardant)	• Short cycle times, for medium to high bulk densities, narrow bulk density distribution • **Particularly low blowing agent content** • Foams with good heat-insulating properties • Foams producible in line with material class E (EN 13501-1)
Neopor® (with flame retardant)	• Energy-saving application, short cycle times, low bulk densities, narrow bulk density distribution • **Foams producible with particularly good heat-insulating properties** • Foams producible in line with material class E (EN 13501-1)
Peripor® (with flame retardant)	• Short cycle times, for medium to high bulk densities, narrow bulk density distribution • **Foams producible with particularly low water absorption in immersion and diffusion testing** • Foams with good heat-insulating properties • Foams producible in line with material class E (EN 13501-1)

Wide range of quality products tailored to meet the needs of processors and users

Economical processing

When it comes to further processing Styropor®, Neopor® and Peripor® to form foam blocks and mouldings, processing plants all over the world tend to carry out three processing steps: pre-expansion, intermediate ageing, expansion. The pre-expansion stage involves forming the compact raw material to form a closed-cell foam, changing the size of the bead-shaped granulate in the process. The following table shows these changes in relation to the degree of expansion (bulk density). Both the pre-expansion process and the process of producing foam blocks and mouldings are characterised by a low energy consumption and short cycle times. The constantly high and controlled quality of the raw materials guarantees smooth manufacturing. Some particular products are only suitable for producing foam particles and are used for things such as aggregates for light-weight concrete, insulating plaster and porous bricks.

Styropor® pre-expansion

Bulk density (kg/m³)	Raw material bead diameter (mm)											
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
8	0.9	1.7	2.6	3.5	4.3	5.2	6.1	6.9	7.8	8.7	9.5	10.4
9	0.8	1.7	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0
10	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6
12	0.8	1.5	2.3	3.0	3.8	4.5	5.3	6.1	6.8	7.6	8.3	9.1
14	0.7	1.4	2.2	2.9	3.6	4.3	5.0	5.8	6.5	7.2	7.9	8.6
16	0.7	1.4	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.6	8.3
18	0.7	1.3	2.0	2.6	3.3	4.0	4.6	5.3	5.9	6.6	7.3	7.9
20	0.6	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.7	6.4	7.0	7.7
22	0.6	1.2	1.9	2.5	3.1	3.7	4.3	4.9	5.6	6.2	6.8	7.4
24	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2
26	0.6	1.2	1.8	2.3	2.9	3.5	4.1	4.7	5.3	5.8	6.4	7.0
28	0.6	1.1	1.7	2.3	2.9	3.4	4.0	4.6	5.1	5.7	6.3	6.8
30	0.6	1.1	1.7	2.2	2.8	3.3	3.9	4.5	5.0	5.6	6.1	6.7
35	0.5	1.1	1.6	2.1	2.6	3.2	3.7	4.2	4.8	5.3	5.8	6.4
40	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.1	4.6	5.1	5.6	6.1
45	0.5	1.0	1.5	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.4	5.8
50	0.5	0.9	1.4	1.9	2.4	2.8	3.3	3.8	4.2	4.7	5.2	5.6
60	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.5	4.0	4.4	4.9	5.3
70	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.2	4.6	5.0
80	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8
90	0.4	0.8	1.2	1.5	1.9	2.3	2.7	3.1	3.5	3.9	4.3	4.6
100	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5
150	0.3	0.7	1.0	1.3	1.6	2.0	2.3	2.6	2.9	3.3	3.6	3.9
200	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6

Bead diameter of pre-foamed Styropor®, Neopor® and Peripor® as a function of the raw material bead diameter and bulk density

Using steam to transform raw material into foam:
Pre-expansion, intermediate ageing, expansion

Properties of foams made of Styropor®, Neopor® and Peripor®

The properties of EPS foams are essentially determined by the bulk density. The following table lists the properties of foams made of Styropor® for the most important bulk densities, namely 15, 20 and 30 kg/m³. Foams made of Neopor® and Peripor® have much better characteristic values for some specific properties. These properties are described in information brochures for the products concerned.

Properties [1]	Verification in Accordance with	Unit	Test results		
Bulk density	EN ISO 845	kg/m³	15	20	30
Thermal conductivity (measurement at 10 °C)	DIN 52612	mW/(m·K)	36 – 38	33 – 36	31 – 35
Compressive stress at 10 % strain	DIN-EN 826	kPa	65 – 100	110 – 140	200 – 250
Modulus of elasticity (compression test)	DIN-EN 826	MPa	1.0 – 4.0	3.5 – 4.5	7.5 – 11.0
Constant load at compressive strain <1 % after 50 years	DIN-EN 1606	kPa	15 – 25	25 – 40	45 – 60
For packaging calculations:					
-Permissible compressive stress	DIN 55471, part 2[2]	kPa		39	71
-Specific cushioning performance C*	DIN 55471, part 2[2]	–		2.5	2.5
-Specific energy/impact energy absorption capacity e	DIN 55471, part 2[2]	kJ/m³		150	250
Bending strength	DIN-EN 12089	kPa	150 – 230	250 – 310	430 – 490
Shear strength[3]	EN 13163	kPa	74 – 114	124 – 154	214 – 244
Tensile strength	DIN-EN 1608	kPa	160 – 260	230 – 330	380 – 480
Short-term dimensional stability under heat	DIN 53424	°C	100	100	100
Long-term dimensional stability under heat (DLT(1)5: Compressive strain at 20 kPa/80 °C/48 h)	EN 1605	%	> 5	< 5	< 5
Thermal linear deformation coefficient	–	1/K	$5\text{-}7\cdot10^{-5}$	$5\text{-}7\cdot10^{-5}$	$5\text{-}7\cdot10^{-5}$
Specific thermal capacity	DIN 53765	J/(kg·K)	1210	1210	1210
Steam diffusion resistance[3]	DIN-EN 12086	–	55	75	85
Fire behaviour of foams made of Styropor® F/ Neopor®/ Peripor®	Euroclass	–	E	E	E
Chemical resistance	Insensitive to water, most acids and bases Sensitive to organic solvents				
Biological behaviour	No detrimental effect on health known				

1: subject to normal conditions, 2: values defined in DIN 55471, Part 2, 3: calculated based on bending strength

Obtaining the required properties simply by determining the bulk density

Thermography of a residential house
Yellow-red: heat loss, blue: well insulated components

1-litre urban terraced houses, Ludwigshafen (Germany)

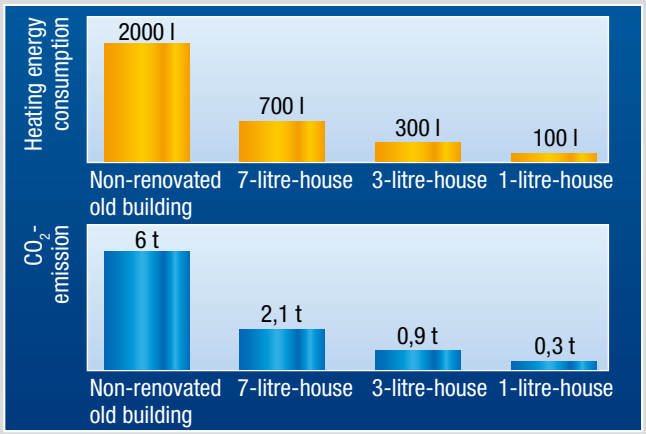
“Les Grottes” insulating plaster façade, Geneva (Switzerland)

Applications of Styropor®, Neopor® and Peripor® in construction

Thermal insulation in buildings plays a key role in reducing the carbon dioxide emissions (CO_2) thought to be the main cause of the greenhouse effect. In this way, effective action can be taken to counteract the greenhouse effect, with the added benefit that heating costs can be greatly reduced.

This is true for both new and renovated buildings. An old building without insulation, for which 20 litres of heating oil is required per square metre of living area each heating period in order to achieve a pleasantly warm temperature, can be transformed into a modern three-litre house.

Efficient thermal insulation is also the basic prerequisite when it comes to realising a future-oriented building – be it a low-energy house, a passive house, a zero-energy house or a plus energy house.



Heating energy consumption/CO_2 emission – consumption and energy comparison using an oil-heated 100 m^2 flat as an example – calculated for one year

One material, numerous applications in the construction sector: Styropor® makes it possible

Sandwich element with a supporting core made of Styropor®

Styropor® as a load-distributing foundation in boggy ground

The Upper House of the German Parliament: renovating outside cellar walls with insulating boards made of Peripor®, Berlin (Germany)

Universal insulation solutions: Styropor® for new and old buildings

Styropor®, a classic when it comes to sustainable insulation and construction solutions, has now been well established in the construction industry for more than 50 years. Despite their light weight, Styropor® products have an excellent insulating capacity and are extremely stable. Moreover, their long-term stability and resistance to decay have been confirmed by numerous experts.

Thermal insulation systems using Styropor® protect façades against unnecessary heat loss. Insulating boards made of Styropor® have proved to be very useful in interior insulation and in double wall masonry. What's more, foams made of Styropor® are also used for flooring insulation, for instance for heat and impact sound insulation underneath screed. The white foam has proved to be an effective and inexpensive insulation solution for a huge variety of applications, for instance in insulating systems for steep roof and flat roof insulation as well as in ceiling insulation.

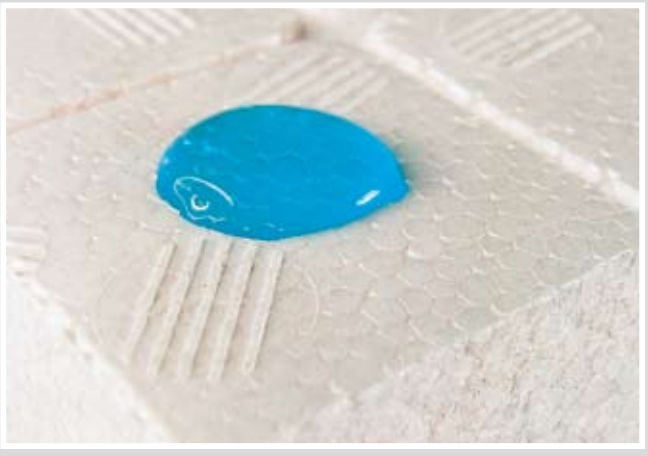
Today, the properties of all sorts of plaster, concrete and clay bricks are improved by adding balls of Styropor®. Moreover, this universal insulating material can also be used in the production of sandwich elements with a supporting core made of Styropor®.

In addition to the applications listed above, Styropor® has also come to be used in building construction (in drainage boards, for lost formwork and to protect foundations and pipes laid in the earth against frost) as well as in road and railway construction. When it comes to road construction in regions where the ground is not able to support much weight, Styropor® is a particularly advantageous solution. Here, light foam blocks are used as foundations to distribute loads while hardly putting any strain on the ground themselves. Numerous roads constructed in this way provide evidence of the cost-effectiveness of this road construction method.

Peripor® for thermal insulation in applications subject to pressure and moisture

When building components are subject to pressure and moisture, the insulating materials used should absorb as little water as possible because water absorption has a significant detrimental effect on thermal insulation. Peripor® has been developed specifically for such applications. It is a product with a water-resistant bead surface, particularly suited to the production of hard foam boards with optimum welding. This combination of properties greatly reduces water absorption.

Typical applications of this material include insulating boards for perimeter insulation, for insulation beneath load-reducing floor plates, for reverse roofs and for roof greening systems.



Insulating board made of Peripor®

Thermal insulation for the toughest requirements:
Peripor® makes it possible

Old building renovation using Neopor®;
Ludwigshafen (Germany): roof insulation
(40 cm), interior insulation (8 cm) and cellar
ceiling insulation (7 to 10 cm)

Social housing construction, London (GB)
Steel frame design with foamed Neopor® (13 cm)

Passive house using Neopor®,
Constance (Switzerland)
Façade insulation (30 cm)

Neopor® sets insulation standards

Unlike conventional EPS insulating materials, Neopor® contains infrared absorbers and reflectors, which reduce thermal conductivity. Neopor® is processed quite simply on conventional EPS machines, creating silver-grey foam blocks or mouldings.

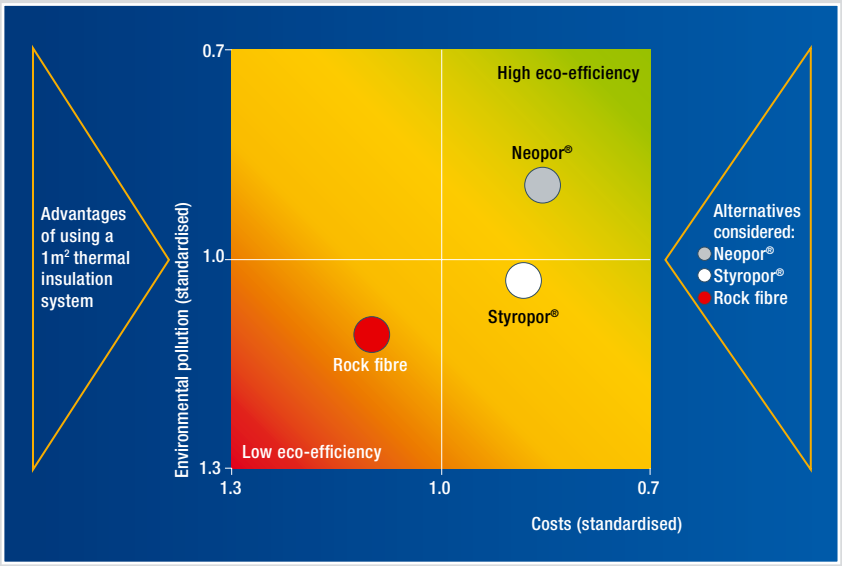
Foams made of Neopor® have a much better thermal insulation properties than the EPS foams common up to now, especially in applications involving low densities. A silver-grey Neopor® board is therefore up to 20 percent thinner than a traditional white EPS insulating material board with the same insulating capacity. This is particularly beneficial for applications – such as the thermal insulation system – where construction requirements make it necessary to limit the thickness of the insulating layer but the insulating capacity needs to be retained.

In addition to being used for façade insulation, Neopor® can also be used anywhere where conventional EPS has proven successful in recent decades.

The eco-efficiency analysis

The eco-efficiency analysis looks at the ecological and economic effects of products and procedures throughout their lifecycle. It compares different applications such as the renovation of a building façade using insulating boards made of Neopor®, Styropor® and mineral wool.

The eco-efficiency analysis enables you to review the entire lifetime of a product, from when the raw material is extracted from the earth up to when the product is recycled after use. The effects on the environment are established based on energy consumption, use of raw materials and resources, emissions, toxicity and risk potential. Compared to other products, Neopor® offers greater benefits combined with lower costs and less environmental pollution. The result is therefore eco-efficient insulation solutions for contemporary thermal protection.



Eco-efficiency analysis of thermal insulation systems using the 3-litre house of LUWOGE in the Ludwigshafen Brunck district as an example.

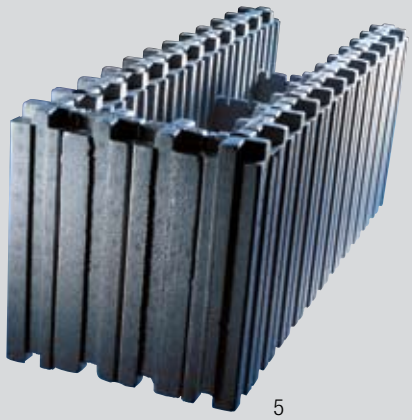
Equal insulation with thinner boards, Neopor® makes it possible


1


2


3


4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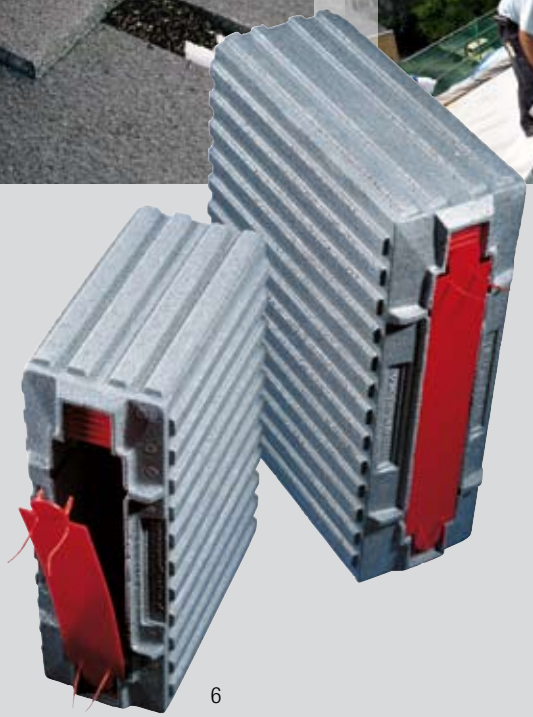
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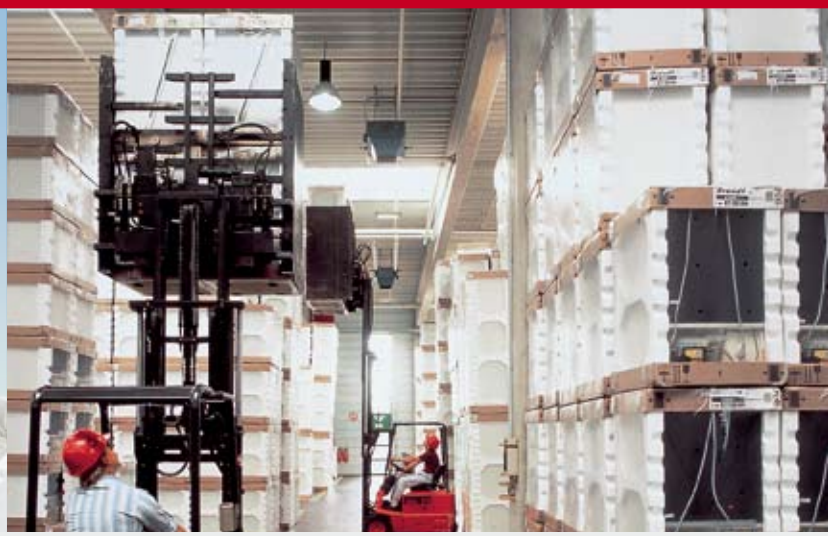
1: façade insulation, 2: interior insulation, 3: impact sound insulation, 4: roof insulation, 5: shuttering elements, 6: moulded parts

Heat-insulating packaging made of Styropor® for fresh fish



Pressure-resistant packaging made of Styropor® for refrigerators

Economical and safe packaging with Styropor® and Neopor®

When it comes to choosing packaging, attention is primarily paid to the basic function, i.e. protecting the goods to be packed. Requirements may change from product to product and from industry to industry depending on the protection required. At the same time, packaging costs needs to be minimised.

The wide range of properties and the individual flexibility of foams made of Styropor® and Neopor® make it possible to develop economic solutions for demanding packing tasks, ranging from fish crates and padding for high-quality electronic equipment to combined packaging with shrink film for washing machines. Self-supporting full packaging is used to protect goods against all kinds of external influences.

Other typical areas of application for Styropor® and Neopor® packaging are as follows: half-shell inserts, corner and edge protection, boxes and crates as stackable containers, sorting and collecting inserts, transportation and collection pallets, and packaging that protects goods against the cold or the heat.

Using particularly simple and economic production procedures, foam parts made of Styropor® can be manufactured in pretty much any shape for all sorts of packaging tasks. The straightforward particle foaming procedure even makes it fairly easy to strengthen the designs of packaging for particularly sensitive goods in the form of strengthening ribs or beads.

Almost anything can be packed using Styropor® and Neopor® – no matter what the shape or application

Collective Styropor® packaging for cathode ray tubes

Heat-insulating shipping boxes made of Neopor®
for blood bottles and organs

As a result of their chemical and physical properties, Styropor® and Neopor® are particularly good for use as packaging material:

- **Low bulk density – low packaging weight**
- **High energy absorption – low packaging wall thickness**
- **Abrasion-proof and soft surface – protecting packed goods against damage**
- **Low thermal conductivity – protecting packed goods against rapid temperature changes**
- **Insensitivity to water, bases and most acids – constantly good mechanical packaging properties**
- **Easy shaping – easy design adjustment of packaging to packed goods**
- **Recycling suitability – protecting the environment**

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, this data does not relieve processors of the responsibility of carrying out their own tests and experiments; neither does it imply any guarantee of certain properties or of suitability for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. specified here are subject to change without prior notice and do not constitute the agreed contractual quality of the product. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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