Styropor®
the **original** among insulating materials

BASF
The Chemical Company

Styropor® stands for efficient construction and reliable packaging. Insulating and packaging materials made of Styropor® stand out for their low weight and good shock absorption capacity.

Applications
- Construction
- Packaging
- Consumer goods
- Low to High Density Products

Properties
- Excellent thermal insulation capacity
- High compressive strength
- Outstanding impact absorption
- Low weight
- Imperviousness to moisture

Contact:
Website: www.StyroporEPS.com
E-mail: $Styropor_Customer_Service@BASF.com
Call: 1-800-922-0380

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Styropor®

Expandable Polystyrene (EPS)
For construction applications

What is STYROPOR® EPS?

EPS is manufactured from expandable polystyrene beads containing a blowing agent and flame retardant additive. Steam heat expands the blowing agent to produce moisture-resistant, multi-cellular particles or pre-expanded beads, which increase up to 40 times their volume during the process. Following an intermediate period during which the beads lose their moisture, the blowing agent condenses out and air diffuses into the cellular structure. After the air has been stabilized, the preexpanded beads are thermally steam fused into blocks, which then are cured and cut into slabs, sheets or other shapes. EPS insulation can be molded in a range of densities to meet specific application requirements. Thanks to its closed cell, unique, air-filled cellular structure, its resiliency and light weight, and its ease of convertibility from raw material to finished product, EPS works well under all kinds of applications.

Get more, pay less

EPS provides the highest R-value per dollar of all generic rigid insulation types on the market and is found throughout the United States and Canadian construction industry. Insulation manufacturers use it for a broad range of products— both conventional and innovative— for every kind of building insulation application. Given its low cost, EPS insulation should be at the top of your list.

General Application

Rigid EPS boards, in whatever size and thickness required, can be used for roofing, walls, foundations, heavy construction and perimeter insulation with relative ease regardless of the structural system or exterior finish.

EPS roof insulation can be installed quickly and easily, with limited labor. Easy to handle in large pieces thanks to its rigidity and light weight, simple to cut and shape with ordinary tools and offering a high thermal efficiency/low material cost ratio, the product provides both an economical and structurally strong, effective permanent base for membrane installation.

Industry Acceptance

Since 1951, EPS has been one of the most widely used thermal insulations in the world and is applied increasingly in architecturally designed, energy-efficient buildings.
Its low cost, versatility and high R-value per dollar make EPS insulation the preferred product of architects, specifiers and application contractors across the country. Its recyclability is an added bonus.

Buy with confidence

The industry provides a voluntary, third-party quality assurance program to help participating manufacturers control product quality and monitor compliance to US and Canadian Standards.
Consumers, architects, specifiers, building owners, home builders, roofers and insulation contractors can benefit from this nation-wide program by specifying the purchase of labelled products.
Intertek Testing Services (ITS), QAI and Underwriters' Laboratories (UL) and Underwriters' Laboratories of Canada (ULC) ensure the quality control plan and product compliance to the standard.

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ICC Building Materials Evaluation Compliance

EPS Type 1, 2, 8, 9, 14 and 15 manufactured in the USA must meet the physical property requirement of the ICC Acceptance Criteria 12 and the American Society for Testing and Materials specifications to C-578 for preformed polystyrene thermal foam insulation.

CCMC Building Materials Evaluation Compliance

EPS Types 1, 2 and 3 insulation, manufactured in Canada, must meet the physical property requirements of the Underwriters' Laboratories of Canada specification CAN/ULC-S701-11, for preformed polystyrene thermal foam insulation.

Roof Deck Construction

EPS insulation manufactured from BASF STYROPOR® bead has been successfully evaluated by Factory mutual under FM 4450 and FM 4470. In addition to CAN/ULC S126m for compliance under C7 and C12 roof deck construction in Canada.

Architectural Products

Types and Sizes

In addition to standard EPS board insulation, various types of laminated products are available. Prefabricated EPS core panels laminated with metal or plywood skins are available for exterior-wall applications. Advanced roof insulation systems, developed and manufactured by EPS insulation molders, offer great design versatility and a wide range of multi-use extras: high thermal resistance at low unit weights, for significant dead-load reduction; pre-tapered (sloped) insulation panels for adequate drainage of flat decks; ship-lapped edges to eliminate excessive heat loss at through-joints; plant laminated or field-applied (mop and flop method) high-strength wood fibreboard; laminated composite panels for maximum resistance to hot mopping of asphalt and traffic damage; base for single-ply membrane.

EPS is available in thicknesses ranging from ½" to 30" (12.7 mm to 750 mm), widths from 12" to 48" (300 mm to 1200 mm) and lengths from 48" to 192" (1 200 mm to 4 800 mm).

Availability

EPS insulation is manufactured by molders in plants located in almost every state in the US and provinces in Canada, according to recommended processes and under quality-controlled conditions. It is readily available for prompt jobsite delivery. For available sizes, consult an EPS insulation molder in your area or region, or visit www.**epsindustry**.org

Construction with STYROPOR®

Thermal insulation in the construction industry

Energy saving, noise insulation environmental protection requirements are essential features of construction today and will remain so in the future. Even countries with moderate to tropical climates are now making effective thermal insulation a requirement. Indeed, the energy expended on air conditioning buildings in the warmer seasons may well be as great as or greater than that expended on heating in the winter. If additional insulation layers mean restricted freedom in planning and structural design for architects and building contractors, they also lead to the development of new, innovative system solutions. Thanks to their excellent material properties, STYROPOR® foamed plastics today have assumed a significant place in practical construction. Current applications in many countries prove STYROPOR®'s unique versatility as a system material. Fifty years after its invention, STYROPOR® has sacrificed none of its attractiveness.

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Roof construction with STYROPOR®

From a construction physics point of view, no matter its design, the roof is the most highly stressed component in a building. Heat and cold, dryness and wetness, storms and snow on the outside or relative humidity on the inside act either alternately or concurrently. Roof designs and materials have to be adapted to these conditions if the roof is to fulfill its protective function.

Flat and sloped roofs

Roof insulation is an important application for STYROPOR® foamed plastics. Depending on roof design, the insulating material is laid loosely, fixed by hot or cold adhesive or mechanically fastened to the underlying surface.

Insulated concrete form systems (ICFs)

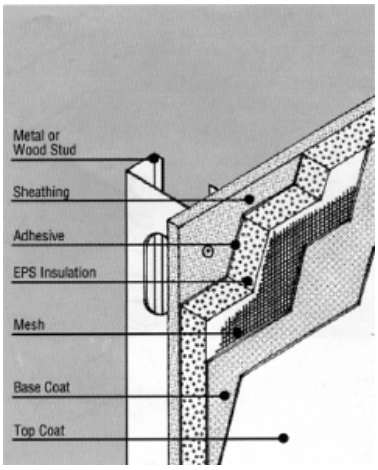
Another system of thermal insulation is the use of molded EPS STYROPOR® part for concrete wall construction. Lightweight, high insulation panel wall units finished with plaster-coated or conventional siding materials have become an established norm and have proven successful, particularly in Europe, the United States and Canada. The permanent, insulated concrete form offers a solid construction, providing a moisture cure and insulation environment for the concrete and an energy-efficient building envelope (foundation and walls) through its high-insulation value and high air-barrier performance.

Structural Foam Panels (SIPs)

The construction building systems to satisfy the most demanding customer. Panels provide a permanent, superior insulation thanks to STYROPOR®. Easy to install, they reduce labor and material costs. Adaptable to creative design, the systems meet the new energy efficiency building requirements

Exterior Insulation Finish System (EIFS)

A wall is both a load-bearing and protective building unit. It protects the surrounded space against the effects of temperature and weather and against noise. Nowadays, the thermal insulation function is assumed by modern insulating materials such as STYROPOR® foamed plastics. In what is the optimum type of external insulation from a construction physics viewpoint, the STYROPOR® insulating layer is applied on the outside of the load-bearing masonry and weather-protected by a reinforced special plaster. STYROPOR® boards and fabric reinforced plaster coating is a widely used method of external insulation, where the insulating boards are fixed to the masonry by bonding mortar and subsequently covered with a fabric reinforced dispersion plaster. The reinforcement of the plaster layer with alkali-resistant glass tissue sheets is necessary to absorb the material and temperature-dependent stresses in the plaster layer occurring on the insulated facade as a result of temperature fluctuations.



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Earthwork/Geofoam

The special properties of the closed-cell foamed plastic, such as stability and durability, immunity to moisture and ground bacteria and good thermal insulation, have resulted in rigid foam stock being used as a frost-protecting layer in road and railroad construction. This application, in use since 1968, particularly in Scandinavian countries, and applied successfully in other countries as well: the use of STYROPOR® blocks as a load-distributing substructure for road and bridge approach ramps in areas with poor load-bearing soil conditions. In such regions, major settlement of the pavement structure had occurred over the years, requiring expensive renovation work. Use of STYROPOR® rigid foam blocks provided a solution: assuming an apparent density of at least 1.25 pound per cubic foot, (20 kg/m3) these blocks offered the necessary strength properties. The slab stock foam's high bending and shear strength make good pressure distribution possible on muddy ground, and the lightweight structure permanently prevents the road from sinking. Claw plates, stacked up to a height of 10 m, secure the rigid foam blocks against slipping. A 10 cm, steel-meshed reinforced trick layer of concrete is applied before paving. STYROPOR® This construction method has been applied very successfully in Canada, the U.S. and Japan for a number of years.

Superior Characteristics

Permanent insulation value

EPS insulation Types 1, 2 and 3, tested at 75°F (24°C), provide typical permanent R-values (see Table of Typical Physical Properties). EPS insulation's R-value is permanent thanks to its unique cellular structure, which contains only stabilized, entrapped air. **Aging has no effect whatsoever upon EPS's performance.**

Moisture resistance

Of all plastic polymers used for insulation applications, EPS is among the most resistant to the adverse effects of moisture, and has good moisture resistance properties for use in construction. Though its water vapor transmission property is moderately low, **EPS is not a vapor barrier;** it is relatively permeable. Its uniform cellular **closed-cell** structure allows the diffusion of moisture/water. Because EPS will not trap water vapor within the exterior walls, it needs no costly venting as do some of the other relatively impermeable insulation materials.

Condensation, which may build up within any insulation material under critical vapor flow conditions, only marginally affects EPS's thermal performance. In tests carried out by U.S. Army Cold Regions Research and Engineering Laboratory, the only significance of moisture gain in expanded polystyrene insulation is the effect on thermal value when exposed under typically severe moisture exposure conditions. At 4% by volume water content, Type 1 EPS has been shown to retain 93% of dry R-value.

Freeze/thaw resistance

As part of the Housing and Urban Development Association of Canada's (HUDAC) overall program to evaluate below-grade foundation insulation techniques, a test procedure was developed to define effects of freeze/thaw exposures.

Properly fused Type 1 EPS was exposed to freezing action and thawing in a 4% sodium chloride salt solution for 50 cycles. The salt solution added severity to the test. **Test results after 50 cycles of freeze/thaw conditions revealed no effect on the exposed EPS board cell structure or structural integrity.** Also, where a cementitious protective finish was used, no delamination occurred between the finish and EPS insulation. Furthermore, EPS core samples removed from aged, existing freezer walls prove that EPS withstands freeze/thaw cycling without loss of structural integrity or physical properties.

Strength
Under normal-use conditions, the compressive strength provided by Type 1 EPS board usually exceeds most design requirements. Depending on load conditions and need for rigidity and long-term compressive strength, a denser Type 3 or Type 9, 14, 15 EPS board may be required. The resilience of EPS insulation board provides reasonable absorption of building movement without transferring stress to the outer facings at joints.

Material permanence
EPS insulation is an inert, organic material. It provides no nutritive value to plants, animals or microorganisms. It will not rot and is highly resistant to mildew.

Low toxicity
Extensive test programs have been conducted to determine if thermal decomposition products of expanded polystyrene (EPS) present a toxic hazard. From a report by the National Research Council in Ottawa, relating to a flammability test on polystyrene: “The maximum toxicity index obtained from the combustion of polystyrene was of the same order as that from wood. Thus, on a weight basis, the potential hazard due to toxic combustion is about the same as that from wood.”

Limitations
Flammability characteristics
Like many construction materials in use today, EPS insulation, as all other organic materials manufactured from expandable polystyrene beads, must be considered combustible when directly exposed to high-heat energy or to massive, continuous fire sources. NFPA 286, and N.B. Code of Canada requirements should be met for adequate protection or separation from occupied areas.

Solvent attack
EPS is subject to attack by petroleum-based solvents. Care should be taken to prevent contact between EPS and these solvents or their vapors.

Vapour barriers
Although EPS provides a high level of moisture resistance and moderate water vapor permeability, normal design practices should be followed in the selection of vapor and moisture barriers for severe field exposures.

Ultraviolet degradation
Prolonged exposure to sunlight will cause a slight discoloration and surface dusting of EPS insulation. The insulating properties will not be significantly affected unless exposure is so excessive that thickness is lost. To prevent ultraviolet degradation, installed EPS insulation should be covered as soon as possible.

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Expanded STYROPOR® and its impact on the environment

In principle, there are no problems in recycling or disposing of scrap from STYROPOR® foamed plastic It does not give off any harmful substances in air, water or soil and so is suitable for whatever method of recycling or disposal chosen.

Recycling

Within certain limits, clean, grounded foam scrap can be reused for special moldings or slab stock. Many production plants make use of this cost-effective possibility.

Grinding

The grinding of used STYROPOR® foamed articles produces an additional brand product: Styromull®. The flake size aimed for ranges from 4 to 25 mm. Styromull is a soil additive that is used to improve substrates and soil, as a composting additive, as a filter material in pipe drainage and as a filler material in slot drainage.

Melting

STYROPOR® foamed plastics are thermoplastics that can be converted by simple melting processes into the compact starting product polystyrene.

Incineration

STYROPOR® foamed plastics can be burned in municipal refuse incinerators at the usual temperatures (about 1000°C) if an adequate supply of air is provided. This applies in particular to scrap in a coarsely reduced form and mixed with other types of scrap. When STYROPOR® foam scrap with fire retardant is incinerated, the small quantities of halogen compounds do not cause any measurable changes in the composition of the fumes.
The toxicity of the gas from burning and low temperature carbonization is lower than, for example, that of the same amount of wood or cardboard. The high energy contents of STYROPOR® foamed plastics (1kg = 1.2-1.41 of heating oil) reduce the need for additional firing. In large-scale STYROPOR® processing plants, the foam scrap also can be used to generate steam, provided the steam generator is equipped with a special combustion chamber and special control devices. STYROPOR® foam scrap must be burned outdoors due to the considerable formation of soot.

Dumping

There are no problems in depositing the scrap at properly organized refuse dumps. However, the scrap should be reduced. This saves space, avoids the formation of air pockets and facilitates compaction. The foam scrap improves the airing of the dump and thus contributes to a faster degradation of the organic substances dumped with it. This summary illustrates three positive aspects in the handling of STYROPOR® foam scrap:

- The conversion of used foamed articles into Styromull or recycled polystyrene produces new, saleable products from scrap.
- The high heating energy of the materials can be used cost effectively in refuse incinerators or special combustion chambers.
- If disposed of properly, no environmental pollution is likely.

The ozone layer

The EPS foamed product manufactured from STYROPOR® bead does not, and never has contained any CFC (chlorofluorocarbons) nor HCFC (hydrochlorofluorocarbons), products known to deplete the ozone layer.

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Research and Development

Inventing a material and launching it on the market is one thing, but sustaining it as a market leader over a number of decades and assuring its lasting attractiveness is another. This demands considerable efforts in the areas of research and development, efforts that only a large research-intensive company such as BASF can maintain over the long term. STYROPOR® is still undergoing BASF research today, mainly on new processing methods and applications. As a result, new grades are regularly being introduced into our product range. BASF's strength, however, lies not only in its product know-how but also in its comprehensive knowledge of product processing and applications. Providing technical counsel and assistance to our customers— ranging from processing optimization, machine development, questions of construction, packaging design and calculation to complete factory planning— is also one of our strong points. Thanks to constant development and decades of market experience, BASF has the widest range of raw materials and a good many specialties.

BASF Corporation The Chemical Company
1609 Biddle Avenue | Wyandotte, MI 48192 USA

Styropor Customer Care Team
Tel: 1-800-543-1747
Fax: 1-800-659-3698
E-mail: $Styropor_Customer_Service@basf.com
Website: http://www.StyroporEPS.com

Further Information: This brochure provides only a broad outline of Styropor® foamed plastics' many applications. Details on application techniques, structural engineering and construction physics are contained in the "Technical Information" publications published by BASF as well as documents put out by expanded polystyrene molders.