

Neopor® Won't Get a Sunburn

■ Insulation Materials Made of Neopor® Have Proven Performance

This information sheet from BASF provides facts and figures about Neopor® and the sun.

More than 10 years of positive experience with insulating materials made of Neopor underpins their quality. Many millions of square metres of facades, roofs, and other components in nearly every corner of the world, have been insulated with these silver-gray panels. Tests prove that insulating materials made of Neopor can be used reliably, even in the hot desert Emirate of Abu Dhabi.

Additional scientific tests by the Fraunhofer Institute for Solar Energy Systems (ISE), the largest solar research institute in Europe, provide further facts. The surface heating of white, white-gray mixed, and gray insulating boards were measured there.

Conclusion:

High-quality insulative materials made of Neopor are reliable, even under high solar loads. See the following pages for more information.



Facade insulating panels made of Neopor® are reliable, even when working in the sun

■ Sunbeams Provide Light and Heat

When sunlight strikes the surface of the earth, or generally the surface of substances, a reaction takes place. Depending on the type of surface being irradiated by sunlight, the following effects are evident:

The radiation is

- partially transmitted,
- partially reflected,
- partially absorbed, that means, it is received by the surface and converted into heat.

The color and structure of the surface or material being impinged on by sunlight plays a significant role.

Example:

White surfaces—including white insulating boards—reflect a great deal of light. This means that they can even cause blindness when processed at the construction site. Very dark surfaces absorb a great deal of radiation, which heats them up more severely.

Depending on the intensity of the radiation, even light-colored facade

constructions irradiated by the sun can heat up to over 50°C before applying plaster or insulating. For very dark facade constructions, surface temperatures can reach over 80°C under direct sunlight. This heating has a significant influence on the construction components, such as the masonry, concrete, etc. Experienced professionals are familiar with this natural process. They check to make sure that the substrate is suitable before applying plaster or gluing insulation boards onto the wall. Industry standards and technical information make reference to this well-known physical effect.

■ What Is Neopor®?

Neopor® is composed of small black beads made of expandable polystyrene granulate (EPS). The graphite particles embedded in the insulation material act as infrared absorbers or reflectors, and prevent the heat flow that is typically caused by radiation.

BASF produces the raw Neopor material, which foam manufacturers turn into insulation materials for a wide variety of applications.

The black beads of raw material are first expanded by the BASF customer, then thermally welded into silver-gray moldings, or into large-format foam blocks, which can be cut into insulation boards of any required thickness.

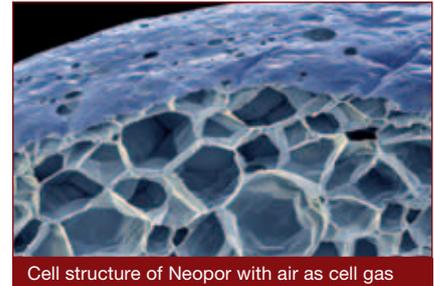
Advantages of Neopor® over conventional EPS:

- Significantly greater insulation value
- Greatly reduced raw material consumption
- Cost and resource savings
- Reduced environmental impact

Foams made of Neopor® contain only air as cell gas. This proportion is about 98 % in finished insulation materials made of Neopor!



Black raw Neopor® beads and expanded EPS beads made of Neopor



Cell structure of Neopor with air as cell gas

■ Quality Assurance for EPS Insulation Materials

In many European countries, EPS processors and manufacturers of insulation materials made of Neopor are organized into associations. The umbrella organization European Manufacturers of Expanded Polystyrene (EUMEPS) was founded in 1989.

Further information available at:
www.eumeps.org

The member directories of EUMEPS contain links to the respective country associations. The individual country associations can also provide details about national quality directives for EPS products, and thus also for insulation materials made of Neopor.

Insulation boards made of Neopor with documented quality directives provide security both for the processors and the builders!

■ Applications with Insulation Materials Made of Neopor

Insulation materials made of Neopor can be used in all construction applications where the white, classic insulation material Styropor® has been used in the past 55 years.

This includes:

- Interior and exterior insulation
- Flat roof and pitched roof insulation
- Core insulation for cavity walls
- Attic insulation
- Basement ceiling insulation
- Insulating Concrete Forms (ICF)
- Footfall sound insulation, etc.

Insulation materials made of Neopor can significantly reduce heating fuel consumption on cold days. In warm regions, effective insulation can also reduce cooling energy for air conditioning systems.



Facade insulation boards made of Neopor



Insulating concrete forms (ICF) made of Neopor



Flat roof insulation with Neopor



Pitched roof insulation with Neopor

■ Outdoor Storage

Contrary to prevailing standards, gray insulation boards are occasionally shipped with transparent film packaging. When these packages are stored outdoors, intensive sunlight can lead to a magnifying glass effect, thus causing the packaged boards to melt.

Tip:

In general, EPS products—like other construction materials—should not be stored in direct sunlight any longer than necessary.

If packages of boards are stored in the sun for a longer period, however,

it is recommended that the top insulation board, which has been exposed to the sun, be placed aside, and the next board used first.

For insulation boards made of Neopor® that are packaged in opaque, nontransparent film, there is no magnifying glass effect.



Packages of insulation boards made of Neopor®, in opaque film, stored outdoors

■ Substrate and Adhesive

There have been reports of insulation boards detaching from walls under intensive sunlight. This effect is not caused by the standardized gray insulation boards that are presumably heated up, but rather caused by the wall surface that is heated by intensive sunlight.

It can therefore happen that the adhesive, which was used to glue the insulation boards to the wall, has the necessary moisture extracted from it too rapidly. Because this so greatly reduces the tensile bond strength of the adhesive, the insulation boards can detach from the exterior wall. Shading the facade can help with this.

Tip:

Other helpful practice is to perform insulation work, especially applying adhesive to the boards, opposite the direction of the sun. This means that the adhesive is always applied to the 'cool' wall in the shade.

Important:

Apply the minimum amount of adhesive to the insulation boards, according to certifications, processing guidelines and the manufacturer's instructions. If too little adhesive or the wrong adhesive is applied to the insulation boards, this can lead to detachment of the boards.

Avoid gluing insulating boards, of whatever type, to heated exterior walls.



Secure adhesion of the insulation boards with sufficient adhesive according to the manufacturer's instructions

■ Long-Term Durability

Insulation materials made of EPS, such as Styropor®, have been used in construction since 1957. The silver-gray insulation boards made of Neopor® have also been proven effective all over the world.

In many countries, several million square meters of insulation boards made of Neopor are successfully installed in ETICS every year.

There are no failure reports that lead back to the insulation material Neopor as a root cause.

The permeability to thermal radiation is largely eliminated in Neopor by the integrated infrared absorbers and reflectors. These embedded graphite particles are also the reason for the silver-gray color of the boards made of Neopor. Due to their color and the infrared absorbers, which positively

affect the thermal insulation properties, the boards and elements made of Neopor heat up more than white EPS products when the sun shines on their surfaces.

Heating in the sunlight is purely a surface effect!

Many field trials show that, when handled properly, even on hot summer days with cloudless skies and extremely high air temperatures, insulation materials made of Neopor remain unaffected.

Even a long-term durability test in hot Abu Dhabi confirmed the suitability of Neopor.



Processing insulation materials made of Neopor® in the hot sun of Abu Dhabi



Test wall made of Neopor in Abu Dhabi

■ Evaluations at the Fraunhofer Institute for Solar Energy Systems (ISE)

Different insulation board colors have different surface heating effects under direct sunlight.

In order to measure the differences in surface heating for white, mixed white-gray, and gray boards in the sunlight, BASF commissioned the Fraunhofer Institute to perform scientific measurements. The purpose of the evaluation was to obtain precise data with respect to this physical feature for construction purposes, and to be able to compare various EPS boards.

Temperature measurements were taken at the surface and at 1 cm depth, from white, gray, and mixed white-gray boards. A climate chamber with a solar simulator was used for the measurements, where sunlight, wind speed, and temperatures of the outside air can be simulated. Air temperatures of 25, 35, and 40°C, and very high solar radiation were used for the tests.

The results:

At the measured air temperatures, the gray and mixed white-gray boards nearly had the same surface temperature.

In the experiment under extreme conditions, at an air temperature of 40°C and vertical irradiation at a higher intensity of radiation, the surface temperature of the gray and mixed white-gray boards can rise to about 80°C.

Measured temperatures at the surface of the various EPS boards are conducted differently into the depth of the insulation boards, depending on their respective thermal conductivity. The temperature drops significantly with each centimeter below the radiated surface!

Such extreme conditions, however, rarely occur during processing on a wall, because even the hottest noonday sun does not shine perpendicularly onto the insulation boards; rather, it impinges at an angle.



Insulation boards tested at the Fraunhofer Institute, with temperature sensors

Additional tests at other institutes showed that at 4 cm below the surface of the white, mixed white-gray, and gray boards, the temperatures were nearly identical.

External Thermal Insulation Composite Systems (ETICS) with Insulating Materials Made of Neopor®

External thermal insulation composite systems with insulation boards made of Neopor® have been used successfully in new construction and energy overhauls of old buildings since 1999—not only in Germany, but also in many other European countries.

Excellent thermal insulation properties, simple processing on site, and secure and reliable long-term performance are the decisive factors why construction experts in many countries use Neopor increasingly in ETICS.

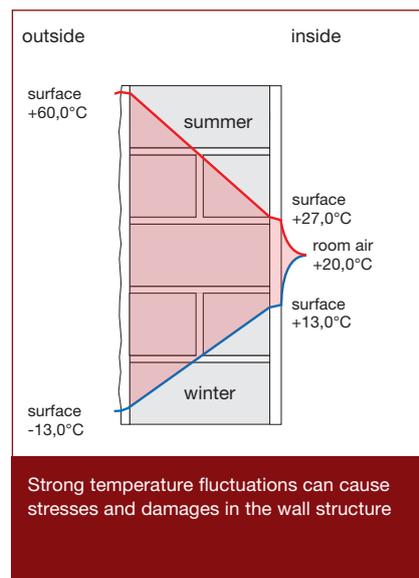
External thermal insulation composite systems also protect the building construction

The exterior wall of a building is both a structural and a protective component. It protects the enclosed room from the effects of temperature and weather, as well as from noise.

The wall construction itself, however, should also be protected against excessive temperature fluctuations.

This protection can be provided simply and very effectively by means of a thermal insulation composite system on the exterior of the building.

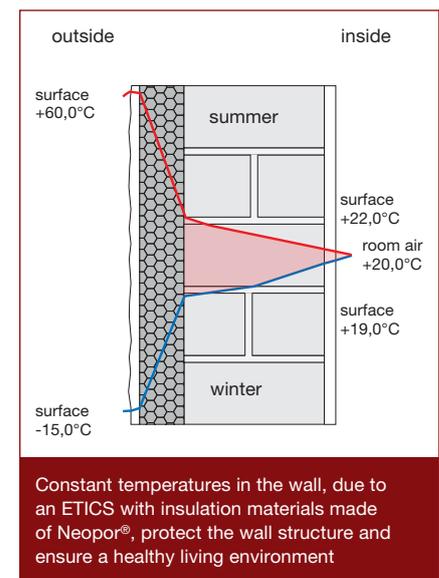
Non-insulated exterior wall



Because the silver-gray boards are available in a wide range of thicknesses, buildings can be built up to the level of a zero-heating-energy house.

In addition, exterior thermal insulation with Neopor ensures comfortable interior wall temperatures, thus promoting a healthy living environment.

Insulated exterior wall



Standards and Approvals

Facade insulation boards and insulation elements made of Neopor in Europe must meet the applicable European standard EN 13163 “Thermal insulation for buildings—factory made products of expanded polystyrene (EPS).” In addition, there are national standards in many countries, which describe the special application-specific requirements for thermal insulation materials. These standards define the required properties for the particular installation situation being planned, such as walls, roofs, ceilings, etc.

Technical approval is required for some construction applications (e.g. external thermal insulation composite systems) as these systems can consist of various layers and materials. Usually, the ETICS supplier applies for this approval.

These construction systems are authorized if there is complete proof of usability of the system and its individual components. This requires extensive measurements, tests, and evidence.

In the EU, a European Technical Approval (ETA) can be obtained. An acquired ETA is a proof of usability. It can then serve as basis for further national approvals (if necessary) in the European Union, and in other member states of the European Economic Community.

Further information available at: www.eota.eu

The member directory of EOTA contains the appropriate links to the accredited registration offices and institutions of the member states. EOTA, the European Organisation for Technical Approvals, currently lists 28 countries as active members.

In addition to the European Technical Approval, there are also national technical approvals (NTA). These are valid only for the country in which the approval is issued.

The Deutsche Institut für Bautechnik (DIBt) (German Institute for Building Technology), for example, is the German office that issues national technical approvals (NTA) for construction products and types.

Further information available at: www.dibt.de

Important:

The valid NTA or ETA must be kept by the ETICS provider for all involved parties. It should be available at the construction site according to the demand of the approval institutes—simply to be on the safe side.

■ Shading the Facade

Unplastered walls or walls without insulating boards installed can heat up excessively in the sunlight. Because this can negatively affect the plaster and most adhesives, it is often recommended that the facade be shaded with scaffolding nets.

Stucco, painter, decorator, and plasterer associations expressly recommend this. For example, a joint data sheet from the Deutsche Stuckgewerbebund (German Stucco Craft Association), the Österreichische Arbeitsgemeinschaft Putz (Austrian Plasterwork Consortium), and the Schweizer Maler- und Gipserunternehmer-Verband (Swiss Painter and Plasterer Association), issued in 2001, recommended shading the facade for typical plasterwork and high temperatures.

The standards, such as DIN 18 550, reference consideration of weather effects when applying plaster. Excerpt: "In order to prevent rapid water extraction from the fresh plaster due to severe sunlight, wind, or constant draft, special protection requirements are required for exterior plasterwork."

Important reasons for applying scaffolding nets:

- Protection against excessive heating of the wall structure
- Protection of craftsmen from overly intensive sunlight
- Protection of the construction site environment from contamination
- Visual barrier

The sun may well shine upon properly compounded Neopor® insulating boards!

However, scaffolding nets prevent the wall structure from heating up due to intensive solar radiation, and serve as protection for workers and for the environment!

■ Sample Buildings with Insulation Boards Made of Neopor®



Bâtiment Génération E, France

Complete renovation of an old town house villa near Paris. Reduced energy consumption from 400 kWh to less than 50 kWh per m² is obtained primarily by insulating the exterior walls (ETICS), the roof, the floor, and ceilings with Neopor®.



Zero-heating-energy house, Germany

In order for the building to achieve the lowest possible heating costs, an external thermal insulation composite system with insulating boards made of Neopor was used. Energy for electrical power, hot water, and heating is obtained by using regenerative energy sources.



Passive apartment building, Switzerland

Using facade insulation materials made of Neopor, the energy costs for the first Swiss apartment buildings that use the passive house standard were dropped by 90 % compared to conventionally constructed houses. This success was honored with the Swiss Building Prize.

BASF SE
67056 Ludwigshafen
Germany

www.neopor.de
neopor@basf.com