Selection of insulation materials and systems

Foamed polystyrene or mineral wool?

The heat conductivity coefficients for both materials are similar. Savings in energy consumption would consequently be the same if thermal insulation boards had the same thickness.

Which system should be chosen? Should it be based on foamed polystyrene or on mineral wool?
Both solutions have their advantages.
Both can be applied on new buildings as well as on buildings in need of renovation. Yet, there are differences between foamed polystyrene and mineral wool, which can influence the final choice of system.

Most important properties of foamed polystyrene

Foamed polystyrene is not capable of absorption and does not lose its thermal insulation properties under the impact of humidity. The occasional condensation of water vapour which may occur along the thickness of the foamed polystyrene does not pose a major problem.

Although this plastic material is obtained from processing crude oil, it does not contain any substances injurious to health. Foamed polystyrene is very light and has good mechanical properties (tearing strength approx. 80 kPa, and compressive strength approx. 130 kPa). Sound insulation is not particularly high. The water is vapour transmission coefficient is also quite low: approx. 12×10-6 g/(mhPa). Temperatures above +80°C cause damage to foamed polystyrene as do most organic solvents. In the ETIC systems it is possible to use foamed polystyrene that fulfils the requirements of standard EN 13163:2004 for product CS(10)70 or CS(10)80 (a 10% deformation of foamed polystyrene is caused by stresses of at least 70 or 80 kPa). The material therefore conforms with the former classes EPS 15 or EPS 20 (thickness of foamed polystyrene in the range of 15 to 20 kg/m^3).

Furthermore, the material must not cause the propagation of fire, i.e. it must be self-extinguishing and must have the dimensional stability declared by the producer (after a suitable seasoning time). Foamed polystyrene panels cut of seasoned blocks (usually after period of 6-8 weeks) remain flat and do not change their dimensions.

It is permissible to use panels not larger than 120×60 cm.

At present there are EPS boards available in white, dotted white and in graphite colour. These boards, apart from the colour, differ from each other only with the heat transfer coefficient value. Popular opinions of lower adhesion of adhesive mortars in case of graphite boards did not prove to be true. The internal tests conducted at Henkel showed, that the colour of the board had no influence on the board's adhesion properties.

Most important properties of mineral wool

Mineral wool is resistant to high temperature. Wool fibres produced of natural rock start to melt after being exposed for two hours to a temperature above 1000°C. The thermal resistance (when used as a binder) and the hydrophobic property (when used as an additive) are slightly less favourable. Mineral wool is classified as non-flammable/non-combustible material. It also has considerable resistance to the majority of chemical substances. The water vapour transmission coefficient is very high with approx. 480×10-6 g/(mhPa). This ensures the absence of water vapour transmission. The hydrophobic property of mineral wool prevents the rise of capillary moisture and the absorption of water vapour contained in the air. Mineral wool boards have a considerable weight, low rigidity and relatively low strength. Stresses of approx. 40 kPa cause a 10 % deformation. Yet it is the fibrous structure of the board that ensures good acoustic insulation of walls.

The mineral wool used in ETIC systems must conform with the requirements of standard EN 13162:2004 for product CS(10)40 (a 10 % deformation of mineral wool is caused by a stress of least 40 kPa).

Two types of mineral wool boards may be used in ETIC systems. The first one is mineral wool with a disturbed fibre structure (density 120 to 160 kg/m^3, strength at break perpendicular to the board surface >10 kPa), on boards with dimensions of 50-60 cm × 100-120 cm. The second one is a board with a laminar parallel fibre structure, placed perpendicular to the wall surface (density 80 to 120 kg/m^3). Owing to their oblong shape (dimensions in general 20×120 cm), these boards are frequently called lamella boards.

A comparison of the properties of foamed polystyrene and mineral wool

Properties	Foamed polystyrene	Mineral wool
Suitability for mechanical processing (cutting, drilling, lapping)	very good	good
Suitability for surface levelling by grinding	very good	limited
Fire classification	not spreading fire	non-flammable/non-combustible
Resistance to natural ageing factors	limited	good
Resistance to microorganisms	good	very good
Permissible height of application on construction sites	depends on local regulations*	depends on local regulations**
Resistance to organic solvents	no resistance	full resistance
Weight of 1 m^2 thermal insulation at 10 cm thickness of thermal insulation material (adhesive mortar and mineral plaster) [kg]	approx. 15	approx. 30
Surface finishing	mineral plaster ✓ silicate plaster ✓ silicone plaster ✓ silicate-silicone plaster ✓ acrylic plaster ✓	mineral plaster ✓ silicate plaster ✓ silicone plaster ✓ silicate-silicone plaster ✓

* according to Polish regulations: limited to 11th floor or 25 m height

** according to Polish regulations: no limitations

Conclusions

When selecting the thermal insulation system for a building, fire safety is an important issue. For this reason, systems based on mineral wool should be used for the following cases: high buildings (the max. height of a building that can be thermally insulated with a system classified as not spreading fire depends on the local regulations, e.g. in Poland 25 m), buildings with a higher hazard classification (e.g. hospitals, schools, entertainment halls and other public facilities), and storage facilities for flammable materials.

Mineral wool based ETIC systems are also recommended for buildings with a high degree of humidity inside (e.g. catering kitchens, laundries and dry cleaners, water treatment plants, carwashes, public baths etc.) provided that suitable vapour barriers and hydroinsulation materials have been installed. This is due to the fact that the condensation of water vapour poses a hazard for mineral wool as it decreases its thermal insulation capacity. Although the walls of 'wet' facilities are generally covered with ceramic tiles, the materials selected for this kind of environment should be analyzed as to their hygrothermal behaviour. The selection of a mineral wool based system is also recommended for buildings located in a zone of high noise pollution. Boards made of lamella wool are both handy and flexible and thus ideally suited for buildings with a curved outline.

Foamed polystyrene based ETIC systems are most frequently used for the thermal insulation of new buildings, but also for the thermorenovation of existing residential housing as well as for individual investment projects.

Among others, this is due to economic reasons. Facade wool is more expensive than foamed polystyrene. Foamed polystyrene, which is almost ten times lighter is more convenient for transport and storage. Also the mechanical fixing is cheaper as it can be done entirely with plastic fasteners (for mineral wool anchors with metal spindles are required). EPS boards are much easier to process and can be cut and polished without major problems. As a result, labour costs for wool based systems are higher by at least 20 to 30%. One should bear in mind that during the time that EPS boards have been in general use for ETIC systems (mineral wool has been in use for a much shorter time), no cases of fire propagation caused by ETICS have been recorded. When choosing foamed polystyrene, there is no danger of excessive load to the building wall. The application of wool for thermal insulation of multi-layer walls necessitates the use of sufficiently long anchor fasteners.

As a result, depending on a region and country, 70–90% of thermal insulations are done with foamed polystyrene. In coming years, this proportion might change due to increasing competitiveness of mineral wool producers offer and also to mineral lamella boards being more popular.

Ceresit Ceretherm Systems

Foamed polystyrene	Mineral wool
Ceresit Ceretherm Popular	Ceresit Ceretherm Wool Classic
Ceresit Ceretherm Classic	Ceresit Ceretherm Wool Premium
Ceresit Ceretherm Winter	Ceresit Ceretherm Wool Garage
Ceresit Ceretherm Premium	
Ceresit Ceretherm Ceramic	
Ceresit Ceretherm Express	
Ceresit Ceretherm VISAGE	
Ceresit Ceretherm Reno	