GOOD PRACTICES IN SME

Insulating outside walls

Designed by freepik

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Which material can be used to insulate outside walls?

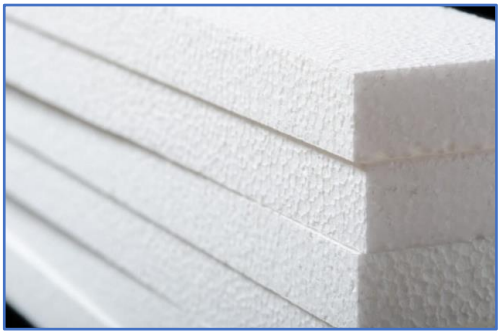
The following materials are most often used to insulate outside walls:

- Polystyrene – light, rigid, not very absorbent, relatively cheap and easy to process.
- Mineral wool– elastic, vapor permeable, non-flammable, absorbs sounds well.
- PIR (polyurethane) boards – non-flammable, not very absorbent, water resistant.

The defining characteristic of these materials is their thermal conductivity coefficient λ $[\frac{W}{m \cdot K}]$. The lower the coefficient, the better the material's insulating properties.

Material	polystyrene	mineral wool	PIR boards
λ $[\frac{W}{m \cdot K}]$	0,031 – 0,045	0,030 – 0,043	0,023 – 0,029

Pic. 1 steelprofil: PIR boards



Pic. 2 styropianonline: polystyrene boads

Pic. 3 bricoman: mineral wool boards

How to choose the thickness of the insulation material?

How well a building's wall is insulated is decided by the heat transfer coefficient U $[\frac{W}{m^2 \cdot K}]$. The lower the value of the U coefficient, the better the partition's insulation. New buildings cannot have a heat transfer coefficient for partitions higher than 0,23 $\frac{W}{m^2 \cdot K}$. In 2021 this requirement will stricter, with a maximal value of 0,20 $\frac{W}{m^2 \cdot K}$.

The heat transfer coefficient U depends on the thickness of the insulating material and its thermal conductivity coefficient λ. This relationship is expressed by the formula: $U = \frac{\lambda}{d}$. The lower the thermal conductivity coefficient λ of the insulating material, the thinner it can be while still offering correct insulation.

How to decide which insulation material is the most cost-effective?

We want to ensure a heat transfer coefficient for a layer of insulation at 0,20 $\frac{W}{m^2 \cdot K}$. We need to insulate 300 m^2 of external partitions. We can choose:

- polystyrene nr 1. with a thermal conductivity of 0,032 $\frac{W}{m \cdot K}$ and an average price of 180 $\frac{PLN}{m^3}$,
- polystyrene nr. 2 with a thermal conductivity of 0,040 $\frac{W}{m \cdot K}$ and an average price of 160 $\frac{PLN}{m^3}$,

The required thickness of polystyrene nr. 1 is:

$$d = \frac{\lambda}{U} = \frac{0{,}032 \ \frac{W}{m \cdot K}}{0{,}20 \ \frac{W}{m^2 \cdot K}} = 0{,}16 \ m = 16 \ cm$$

The required thickness of polystyrene nr. 2 is:

$$d = \frac{\lambda}{U} = \frac{0{,}040 \ \frac{W}{m \cdot K}}{0{,}20 \ \frac{W}{m^2 \cdot K}} = 0{,}2 \ m = 20 \ cm$$

For polystyrene nr.1 we would pay:

$$0{,}16 \ m \cdot \ 300 \ m^2 \ \cdot \ 180 \ \frac{zł}{m^3} = 8 \ 640 \ PLN$$

For polystyrene nr.2 we would pay:

$$0{,}2 \ m \cdot \ 300 \ m^2 \ \cdot \ 160 \ \frac{PLN}{m^3} = 9 \ 600 \ PLN$$

In the case considered it is cost-effective to buy the polystyrene with the lower thermal conductivity coefficient λ.

Source: KAPE