

## THERMAL INSULATION MATERIALS IN CONSTRUCTION

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### **Abstract**

*Modern insulation, developed with the help of the latest technologies, used in construction to insulate the interior of the house. The material "saves" from the winter cold, keeping the room warm, and from the summer heat, retaining the coolness. For any room, insulation will not hurt, regardless of the temperature regime. In the winter cold, the room will be warmer, while the heat will be much easier to bear. Insulation can create a comfortable climate for living and working.*

**Keywords:** insulation, temperature regime, climate, thermal insulation materials, thermal conductivity, thermal energy.

Modern manufacturers try to produce a variety of materials, each of which is designed to perform basic and additional tasks. In the store you can find thermal insulation represented by bundles, granules, etc. In addition, insulation in the form of mats, cylinders and blocks can be preferred.

First of all, it is necessary to pay attention not to the form, but to the content and qualitative characteristics. Heat-insulating materials, the types and properties of which will be described below, must be chosen based, first of all, on the qualities of thermal conductivity. This characteristic indicates how much heat will pass through this material.

It is possible to distinguish two types of thermal insulation, the first of which has reflective characteristics, while the second has prevention properties. The first materials are able to reduce heat loss due to the reduction of infrared radiation. As for the preventive variety, it is used most often. It involves the use of materials with negligible thermal conductivity. Three types play this role, among them – inorganic, mixed and organic [1-4].

**Table 1 – Specifications of the thermal insulating materials**

Materials	Thermal conductivity, W/m °C	Thickness mm, R=1,2 m <sup>2</sup> °C/W	Density, kg/m <sup>3</sup>	Working temperature, °C	Vapor permeability, Mg/(m×h×Pa)
Polyurethane foam	0,025	30	40-60	From -100 to +150	0,04-0,05
Styrofoam (extruded)	0,03	36	30-45	From -50 to +75	0,015
Polyethylene foam	0,045	54	35	From -60 to +90	0,01
Styrofoam	0,05	60	40-125	From -50 to +75	0,23
Mineral plate	0,047	56	35-150	From -60 to +180	0,53
Fiberglass plates	0,056	67	15-100	From -60 to +480	0,53

Organic. They insulate houses with moderate humidity and, most often, only from the inside of the room. This group is represented by the following species:

Wooden:

Average density ranges from 300 to 900 kg/m<sup>3</sup> depending on the species and moisture content. Thermal resistance varies widely depending on the thickness and type of wood, but generally ranges from 0,1 to 0,5 m<sup>2</sup>K/W.

Linen:

Average density ranges from 50 to 200 kg/m<sup>3</sup>. Thermal resistance ranges from 0,034 to 0,040 m<sup>2</sup>K/W.

Cork:

Average density ranges from 110 to 240 kg/m<sup>3</sup> depending on the grade and manufacturing process. Thermal resistance ranges from 0,043 to 0,057 m<sup>2</sup>K/W.

Sea grass:

Average density ranges from 150 to 350 kg/m<sup>3</sup> depending on the species and manufacturing process. Thermal resistance ranges from 0,035 to 0,045 m<sup>2</sup>K/W.

Inorganic. Suitable for warming the walls of the house from the outside and from the inside:

Mineral insulation (the most popular materials are mineral wool and plates): Average density ranges from 30 to 200 kg/m<sup>3</sup>. Thermal resistance ranges from 0,04 to 0,44 m<sup>2</sup>K/W.

Basalt fiber: Average density ranges from 80 to 200 kg/m<sup>3</sup>. Thermal resistance ranges from 0,05 to 0,08 m<sup>2</sup>K/W.

Styrofoam: Average density ranges from 15 to 35 kg/m<sup>3</sup>. Thermal resistance ranges from 0,032 to 0,038 m<sup>2</sup>K/W.

Fiberglass: Average density ranges from 12 to 96 kg/m<sup>3</sup>. Thermal resistance ranges from 0,034 to 0,040 m<sup>2</sup>K/W.

Cellular concrete: Average density ranges from 300 to 1800 kg/m<sup>3</sup>. Thermal resistance ranges from 0,09 to 0,36 m<sup>2</sup>K/W.

Polyethylene foam: Average density ranges from 25 to 200 kg/m<sup>3</sup>. Thermal resistance ranges from 0,033 to 0,046 m<sup>2</sup>K/W.

Mixed These heaters are represented by a composition of organic and inorganic elements. Representatives of the group – rock materials:

Perlite:

Average density ranges from 30 to 130 kg/m<sup>3</sup>. Thermal resistance ranges from 0.05 to 0.08 m<sup>2</sup>\*K/W.

Asbestos:

Note: The use of asbestos in construction and insulation materials is highly regulated or prohibited in many countries due to its health hazards. We strongly recommend seeking professional guidance before using asbestos or asbestos-containing materials.

Average density ranges from 1000 to 1200 kg/m<sup>3</sup>. Thermal resistance ranges from 0,06 to 0,14 m<sup>2</sup>K/W.

Vermiculite:

Average density ranges from 60 to 220 kg/m<sup>3</sup>. Thermal resistance ranges from 0,05 to 0,08 m<sup>2</sup>K/W.

10 important properties of insulation material: what you need to know when choosing

A wide variety of new insulation materials are used in construction. What parameters you need to pay attention to when choosing are discussed below.

Modern thermal insulation materials are characterized by the following properties:

Thermal conductivity;

Degree of porosity;

Degree of strength;

Vapor permeability indicator;

Degree of water absorption;

Resistance to biological processes;

Resistance to fire;

Resistance to temperature changes;

Heat capacity index.

The thermal conductivity parameter of the insulating material depends on other properties – the amount of moisture, degree of strength and porosity, temperature and structure. It indicates how much heat will pass through the surface. The heat conductivity indicator is calculated taking into account a certain area and time (warming through 1 m<sup>2</sup> of material per hour).

In construction, the insulation porosity parameter is important, as the further functionality of the material depends on its extent.

The following types of time are distinguished:

Open;

Closed;

Large;

Small ones.

When choosing a heater, you need to pay attention to the strength parameter. Its minimum and maximum limits are 0,2 and 2,5 MPa. This is especially necessary in the case of material transportation. A high strength indicator will protect the surface from various types of damage [4].

Measuring the degree of vapor permeability will indicate the amount of vapor penetration through 1 m<sup>2</sup> of insulation per hour. The correct calculation assumes the same temperature index from the inside and outside of the walls (despite the fact that they differ). In rainy areas, a high index of moisture absorption of the insulation is necessary. In this case, preference should be given to new materials with moisture-resistant elements in the composition, for example, mineral wool. The following parameter depends on the degree of moisture absorption [3].

The higher the degree of moisture protection of the material, the stronger its resistance to biological processes. Mold, microorganisms, insects, etc. destroy the structure of the coating. Therefore, the insulation must have the property of protection against these processes.

Resistance to the influence of fire is an important safety parameter of insulation, developed according to modern technology. You need to choose a material with a high degree of fire protection.

It is necessary to pay attention to generally accepted indicators of fire safety:

Flammability of the material;

Combustibility;

Formation of smoke;

Level of toxicity.

Resistance to temperature changes is important in all climates. This parameter is represented by a limit indicator. Under its influence, the structure of the thermal coating will begin to collapse.

The heat capacity parameter indicates the insulation's ability to withstand low temperatures. This is especially important for cold areas. A good new insulation freezes and thaws without breaking the structure.

Pay attention! There is no material for use in all cases. To choose a good insulation, you need to take into account many individual factors of the room.

When buying heat-insulating material, you should take into account the main parameters of the surface on which it will be applied, the conditions of use and the climate [5].

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