# HEAT INSULATING LIQUID COATING

**Boburjon Tolibjonovich Tojiboyev**
Ferghana polytechnic institute

**Omongul Maxamadsoli qizi Dexqonboy nabirasi**
Ferghana polytechnic institute

## ABSTRACT

The results of experimental studies on the analysis and improvement of existing methods for determining the thermal conductivity of liquid heat-insulating (insulating) coatings are described.

**Key words and phrases:** thermocouple sensors thermal insulation material, thermal conductivity, microsphere, thermal insulation paint, energy efficiency, stationary method, non-stationary method.

One of the most important tasks to be addressed in the construction of modern buildings and structures is the efficient use of heat in the delivery of hot water from the heat sources (TPP) to the population. The advent of new heat-insulating materials has solved many problems related to energy efficiency in buildings (TPP). Efficient use of thermal insulation coating has helped to optimize construction and heating costs, increase the service life of buildings, improve microbiological performance, create and maintain a favorable microclimate inside the building.

So what is heat? Thermal conductivity? What are the advantages of a heat-insulating coating? Can we answer these and similar questions? Heat is a form of motion of matter; energy expression of the process of heat exchange between bodies. The amount of random motion of the microparticles (molecules, atoms, electrons, etc.) that make up matter represents heat. The terms heat and amount of heat have the same meaning. The thermal conductivity is an indicator of a material's ability to transfer energy from a warmer place to a cooler one. The lower this value, the better the thermal insulation properties of the insulation. Thermal conductivity is affected by the density of the material, the location and number of voids, as well as the vapor permeability and moisture absorption. The thermal resistance of a building or structure depends on its thermal conductivity. That is, how well the structure retains heat in winter and a comfortable temperature in summer.

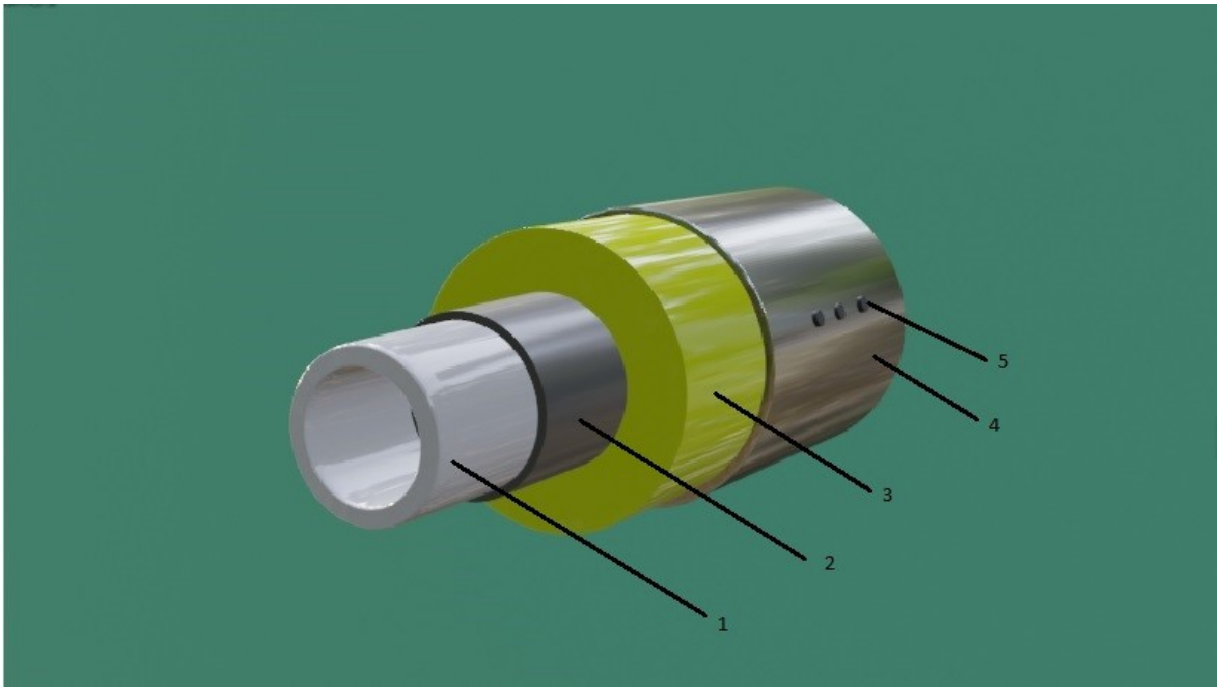
The Youth Center for Innovative Technologies of the Fergana Polytechnic Institute is conducting research to improve the method of determining the thermal conductivity of ultra-thin heat-insulating coatings.

Strict requirements are placed on heat-insulating materials. The heat-insulating coating should be energy-efficient, lightweight, environmentally friendly, provide sound and vapor permeability loss, non-flammable, waterproof, anti-corrosion (corrosion)

when applied to steel products, building and such as reducing heat loss when applied to structures and protecting against mold.

The thermal insulation coating we are researching is distinguished by the fact that it meets the above requirements.

At present, mainly fiberglass (minvata) is used for heat storage. That is, in order to retain heat in a place (pipe), gum (bitumen) is first applied to the pipe, and then a tunic (zinc) is coated on the glass, which is more expensive and time-consuming from an economic point of view. The coating we offer is based on acrylic binders and hollow




Picture 1. 1 - Pipe, 2 - fine-grained bitumen, 3 - fiberglass (minvata), 4 - zinc (tunic) products wrapped on the outside, 5 - samarez

microspheres based on whole fillers and other components

In addition to its thermal insulation properties, the coating, which contains waterproof and anti-corrosion additives, also has waterproofing (anti-corrosion) properties. The components make the coating waterproof, flexible, and at the same time resistant to, temperature drops, moisture and external factors.

Field of application:

− Thermal insulation of external pipes of heating networks, boilers and other equipment;

− Covering pipes to supply cold water to refrigerators operating in rooms with poor air temperature to prevent condensation and corrosion;

− for thermal insulation and protection of facades and interiors of residential and industrial buildings;

After drying, the liquid composition is transferred to a durable, polymer coating, which provides excellent thermal insulation properties that reduce heat loss. The drying layer of one coating forms a film with a thickness of 0.1 to 0.5 mm.

The coating is flexible and has high viscosity at low and high temperatures. The coating does not contain residues of the base material and does not crack during long service life (up to 15 years).

The coating has a high adhesion (adheres to cement-sand plaster, concrete, brick, metal, plastic, wood and other materials), prevents corrosion and condensation on cold surfaces, in addition to mechanical and atmospheric influences does not require protection. Vacuum ceramic or silicone balls inside. They are suspended components in liquid synthetic rubber, acrylic polymers and inorganic pigments. It resembles a light gray suspension and forms an elastic ultra-thin coating after drying. The combination of such components has allowed to create a unique material with flexibility, lightness, elasticity and the ability to perfectly adhere to surfaces of any shape and almost any chemical composition.

Advantages:

- Easy to apply (can be done by spraying with a brush, roller and compressor);
- Conciseness is reflected;
- Not harmful to nature;
- Does not contain harmful substances;
- Good resistance to both alkalis and acids;
- Does not support combustion;

Areas of application:

- Residential and industrial buildings (external and internal insulation);
- Easy-to-install structures;
- Metal structures (garages, containers,);
- Heating mains, pipes, ventilation ducts;
- Shut-off valves (valves and valves);
- Industrial containers;
- Motor showrooms;
- Water transport.

Non-combustible fireproof material. There are two other types of resistance to liquid insulation: temperature and humidity and resistance to ultraviolet radiation. The composition of liquid thermal insulation contains only environmentally friendly components, which allows it to be used indoors and outdoors, in children's institutions, public catering establishments, etc., without restrictions on their functionality.

Easy to apply even in restricted areas. There are several ways to apply liquid thermal insulation to the surface of your choice. You just have to choose the one that suits you best. You can use a variety of tools: brushes, rollers, etc.

If your surface is concrete, use a brush to remove dust, mold, and oil;

− Metal surfaces should also be cleaned and degreased. If there are rust stains on the metal, it is recommended to treat them with a phosphating compound.

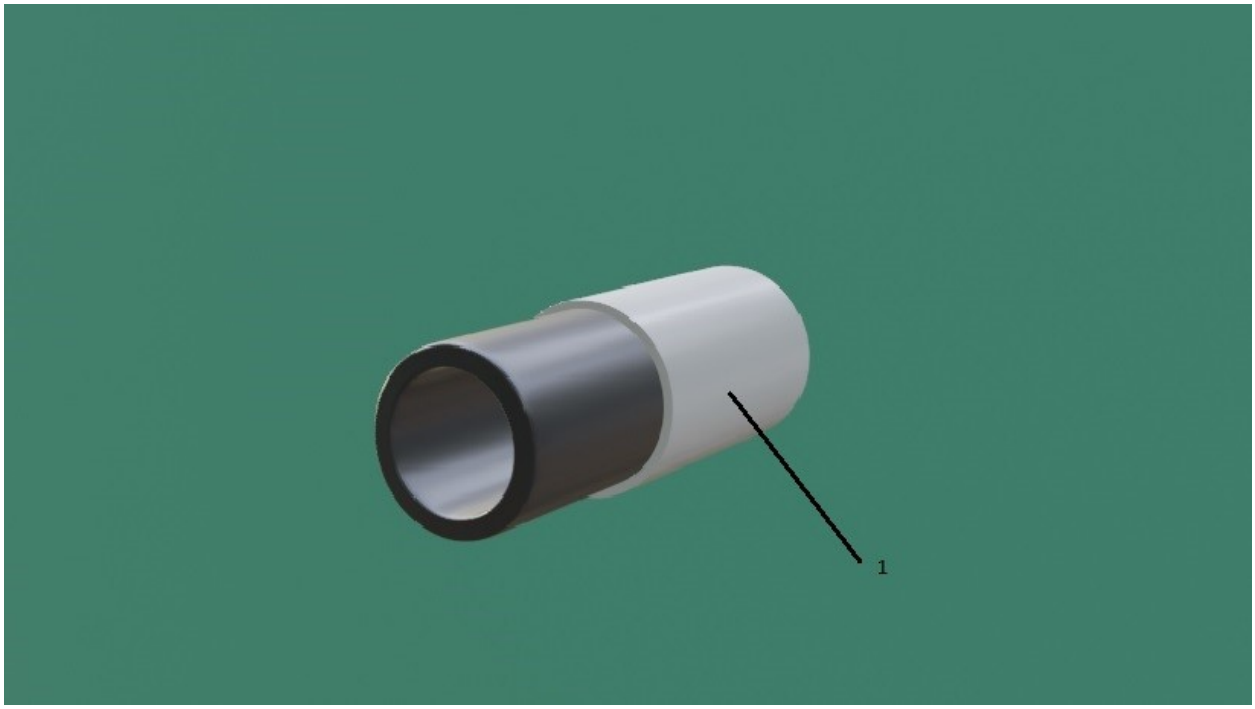
− Before applying the insulation, the wood should be primed with primer and biocides.

− If you are repairing a brick surface, you must first prime it and then plaster it.

Thermal insulation coating is applied to metal, concrete, brick, wood, plastic and many other surfaces. The surface is pre-cleaned, primed if necessary, diluted with water of the same composition (not more than 5%) or as a primer can be used as a primer of any acrylic paint, liquid glass mixture.

Do not push the mixture on a damp, icy surface. The mixture is laid in several layers. The number of layers is determined by the tasks, depending on the objectives. The layers can be applied several times with drying intervals. The final thickness of the finished coating is selected depending on the heat carrier temperature and the desired surface temperature.

The coating is easily (laid) on the surface of any geometric shape using a brush, spatula, roller or sprayer. The coating does not emit harmful compounds into the atmosphere. It is recommended to use a normal respirator when working indoors, and no respirator is required when working outdoors or in a ventilated room. Average consumption for obtaining a dry coating layer with a thickness of 1 mm: 750-1000 g / m2.




Picture 2. 1-The liquid heat-retaining coating we offer

The inspection was outdoors. The coating is laid in 3 layers. The final thickness was 3 mm. Total coating consumption was 0.9 liters.

Procedure for determining the thermal conductivity of thermal insulation coating:

The coefficient of thermal conductivity of liquid thermal insulation coating was calculated according to the following formula:

$$\lambda = \frac{d_u}{\frac{\Delta T_u}{q_u} - 2R_L}, \quad (1)$$

Where $d_u$ is the thickness at the time of sample testing, m;

$\Delta T_u$ - temperature difference at the surface of the test sample, $^oC$;

$q_u$ is the density of the stationary heat flux passing through the test sample, W / m2;

$R_L$ - thermal resistance of the coated copper plate of the test sample (paint), $(м^2 \cdot {}^oC)/Вт$

The density of the stationary heat flux passing through the sample is given by the following formula:

$$q_u = \frac{\lambda_{2қатлам}(t_1 - t_2)}{\delta_{2қатлам}}, Вт/м^2$$

where λ and $\delta$ are the coefficients of thermal conductivity and thickness of the orgstekloni, $t_1$, $t_2$ are the temperatures at the boundaries of the “heat source - orgsteklo layer” and “orgsteklo layer - test specimen”, respectively.

Thickness $\delta$ = 0.5mm. The thermal conductivity of a copper plate is λ = 384 $Вт/(м \cdot {}^oC)$

To stabilize the performance of the equipment during the study, the readings of the three thermocouple sensors were measured at 0.5 h intervals of 5 min to “heat up” all its parts and to stabilize the heat flow transmission. From the graph given in Figure 2, it can be seen that the equipment readings became stationary after 15 minutes.

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