



innovations for people



**THE PRACTICE OF APPLYING
INNOVATIVE
INSULATION MATERIAL**



Liquid Ceramic Thermal Insulation Coating TSM Ceramic

Development of products creation, which are similar to liquid ceramic thermal insulators, began in the 1970s in the USSR and the USA within the programs of defence and industrial complex and the space exploration programs. These materials considered to be used as an alternative to conventional insulation materials in order to reduce products weight and to add properties which increased their work time during operation.

TSM Ceramic entered Russian market in the beginning of 2000s. We obtained material patent and the most effective application technology patent. First it was used in the defence industry. Since 2005 it has been applied in various industries and households. We have gone through long way of this revolutionary technology introducing and we are proud of the result.

Nowadays we are the only manufacturers, who have created a vertically integrated system: our own professionals produce the material and perform all the works, connected with it. How does it look like practically?

Two plants in Russia and Ukraine manufacture **TSM Ceramic**. They are certified in accordance with quality management system ISO 9001:2009. Next year one more plant will be also launched in Europe.

Scientific and technical department carries out examination, energy audit of targeted objects with the issuance of technological decisions on the use of **TSM Ceramic**.



Certified professionals of the construction department provide training of material appliance and performance of work, connected with **TSM Ceramic** material. Using the best equipment of the American company «Graco», they perform all the work quickly and at a low price. Four-stage quality control system with Sweden devices of Elcometer company provide control of maximum quality obtaining.

Practically we conduct a considered analysis of every completed object (there are more than a thousand of them now), we also cooperate constantly with world research and development institutions and laboratories. This allows us to use the latest and the best developments in the world. Improving the properties of **TSM Ceramic** material, we let you work with it more comfortably and efficiently to facilitate your ability to carry out the work on your own.

This provides the consumer with the guarantee of high quality at every stage and we take full responsibility for efficient coating **TSM Ceramic**.

Dear clients and partners! We appreciate your trust and ability to develop and improve our technology constantly. Thank you for going through difficult way of new technologies introduction together! With the help of joint efforts we will obtain the best possible result!

TSM Ceramic Composition

TSM Ceramic consists of film-forming material, ceramic filler and other special additives.

Styrene - acrylic latex is applied as film-forming material. Styrene (about 20%) harden the material and acrylic component (80%) makes material elastic and weatherproof. Film has all the properties of acrylic binder, excellent adhesion (1-6 MPa), elasticity (bending 1 mm), durability (at least 30 years), the material has good vapour permeability (0.0014 mg /m h Pa) and a low water absorption power (0.03 g/cm³).

Ceramic filler is vacuum-processed microspheres, produced for the production of **TSM Ceramic** material only. There are over 75% of them in the final coating. Combined with binder polymers of a low level of heat transfer, they provide **TSM Ceramic** material with high thermal insulating properties.

Material is water-based, fire resistant and environmentally safe, it does not pollute the environment.

Principle of TSM Ceramic operation

Thermophysical properties of **TSM Ceramic** differ significantly from similar properties of conventional thermal insulation materials.

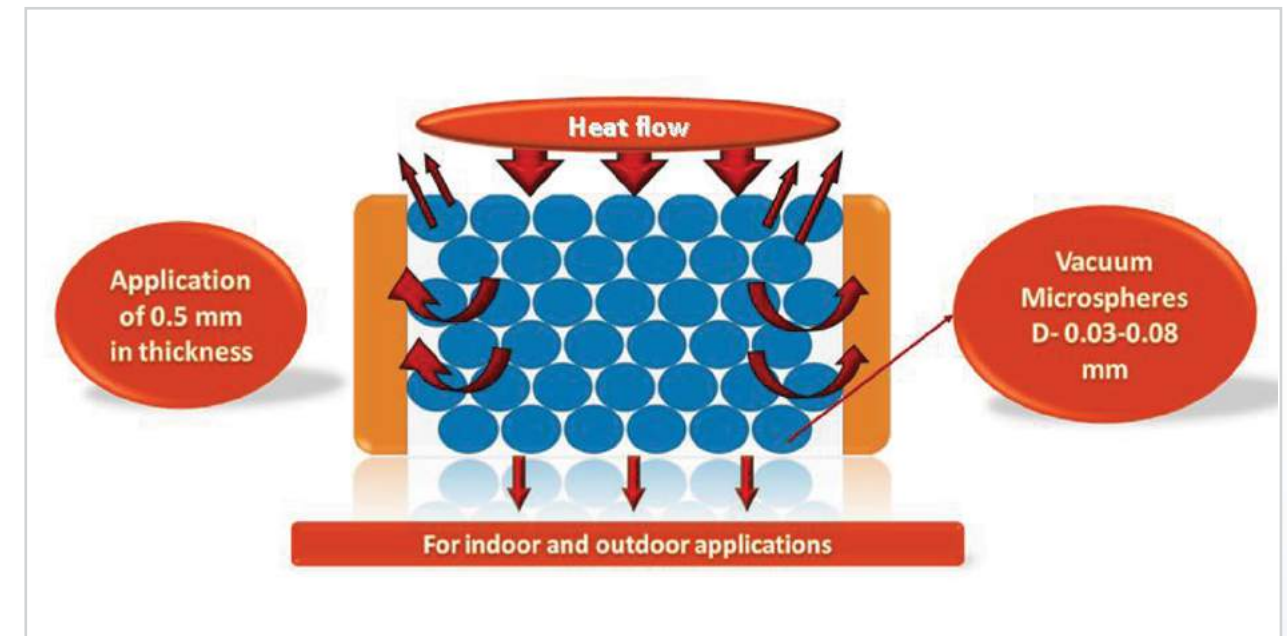
There are three methods of heat transfer:

1. Thermal conductivity is a heat transfer in solids due to kinetic energy of molecules and atoms from more heated part of body to less heated one.
2. Convection is a heat transfer in liquids, gases, granulated solids by means of streams of the substance itself.
3. Radiant heat transfer (thermal emission) is an electromagnetic radiation, emitted by the substance and it arises as a result of internal energy of the substance.

The result of these processes is the thermal equilibrium within the whole system. Insulation quality determines the method and efficiency, by means of which insulating material blocks thermal redistribution, i.e. thermal equilibrium process.

Heat transfer is a convectional exchange or a radiant heat transfer between the surface of a solid body and the environment. The intensity of this heat exchange is characterized by a heat transfer coefficient.

Liquid ceramic thermal insulation material **TSM Ceramic** is a complex, multilevel structure, which minimizes all three methods of thermal transfer. Ceramic thermal insulator **TSM Ceramic** consists on the average of 80% of microspheres, and consequently, only 20% of the binder can transfer heat with the help of its thermal conductivity. Another fraction of the heat falls on convection and emission. The heat loss is not minimal, as there is rarefied air within the microsphere. Moreover, due to its structure, the material has a low heat transfer from the surface that is the most important for its thermal physics.



There are about 50 layers of vacuum microspheres in a layer of 0.5 mm thickness. They create a thermal barrier and prevent the passage of heat flow. Heat flow, coming up against TSM Ceramic, is reflected (70%) and is partly spread (20%), so the heat flow decreases. And, as a consequence, the energy is conserved.

TSM Ceramic, except for heat transfer by thermal conductivity, is semi-transparent for infrared (IR) radiation, i.e. it obtains absorbing, radioactive and scattering properties, which change fundamentally the structure of heat losses from the surface of coating. These heat losses consist of convective losses due to washing the surface by the surrounding air and of

radioactive losses due to wall «shine exchanging» with the ground and the firmament. For these reasons, the heat transfer coefficient of **TSM Ceramic** ($1.29 \div 2.5 \text{ W/m}^2 \text{ }^\circ\text{C}$) is much lower than coefficients of other construction and thermal insulating materials ($9 \div 23 \text{ W/m}^2 \text{ }^\circ\text{C}$).

TSM Ceramic along with other high-tech advantages obtains properties, which rarely occur in one material at the same time:

- thermal insulation property;
- waterproofing property;
- anticorrosion property;
- noise insulation property.



Construction

Practice has proved that the most effective scopes of application of **TSM Ceramic** material in construction are:

- heat insulation of walls of residential and industrial buildings, both inside and outside;
- heat insulation of walls and operational roofs of underground parking;
- heat insulation and waterproofing of walls of basements, ground floors and toilet facilities of buildings;
- liquidation of cold bridges, including along the balcony slabs;
- heat insulation of roofs of residential and industrial buildings, both inside and outside and in combination with other heaters.

TSM Ceramic is used in construction not only as thermal insulating coating, but also as water proofer. Latex in material provides it with low water absorption capacity.

Possibility of **TSM Ceramic** usage as the protection against condensate formation in the premises, allows not only to liquidate frost penetration of walls, but also to remove fungus and mould.

TSM Ceramic can be of any colour. This is an important factor for aesthetic of facades.

With all the outstanding quality characteristics **TSM Ceramic** is absolutely safe for health and it is eco-friendly. This fact was confirmed by various researches. It is also of fire resistant nature that is crucially important while working on heat insulation of facades. In some cases, the use of **TSM Ceramic** is the only possible way to eliminate «cold bridges», which arise because of designers' and builders' defects, and consequences of wrong calculation of «dew point», which are impossible to eliminate by using conventional



materials for thermal insulation of facades (foamed polystyrene, mineral wool, etc.). This becomes particularly evident while working on a complex reconstruction (renovation) of already built structures, including monuments of architecture and buildings with facades of different shapes and configurations.

TSM Ceramic can be used successfully as integrated thermal insulation of the entire facade, and to prevent frost penetration in separate apartments (liquid thermal insulation is applied on the outer and inner surfaces of the walls).

Energy-efficient TSM Ceramic Material

Thermal insulating effect of **TSM Ceramic** material, applied in 1 mm layer, is similar to effect of 50 mm rock wool or 30 mm polyurethane foam.

Advantages of energy-efficient TSM Ceramic paint

1 mm – TSM Ceramic
50 mm - foam plastic
50 mm - rock wool





Cost Savings

1. Labour costs and time of constructing are reduced at least by 30% in comparison with conventional materials, if **TSM Ceramic** is used as thermal insulating material.
2. Operating costs during the heating season are reduced by decreasing of heat losses due to thermal insulation of constructions and internal premises of buildings with **TSM Ceramic**.
3. Operating costs are reduced for air conditioning inside the premises by insulation of roofs and walls of a building with **TSM Ceramic**.
4. Direct costs, appeared while constructing buildings and structures, are reduced due to the reducing of wall thickness, foundation dimensions, if **TSM Ceramic** is applied as a «heat shield».
5. There is no load on the foundation.
6. High lifetime warranty of **TSM Ceramic** material.

Thermal insulation of the facade of Moscow child educational centre was made with **TSM Ceramic** material in autumn, 2009. After **TSM Ceramic** material applying the heat release rate was decreased by 55%.



Application of TSM Ceramic in the construction

TSM Ceramic material proved its efficacy not only within severe Siberian conditions, but also in many other regions of Russia. 28 houses were completely insulated within 47 days in Yuzhno-Sakhalinsk in 2009. The cost of insulation is 2 times lower than the cost of suspended facades and it is 7 times faster.



TSM Ceramic material, due to its structure, allows to isolate complicated constructions, which cannot be isolated by conventional methods (including the reconstruction of monuments of architecture).



Russia, Krasnoyarsk city, insulating material with the use of TSM Ceramic rink



Architectural monument in Vladivostok city



Thermal Engineering

TSM Ceramic is used for thermal insulation and anticondensation protection of capacities for various purposes, of main and internal pipelines: gas and oil pipelines, insulation of heat pipelines, hot and cold water pipelines, steam lines, industrial pipelines.

TSM Ceramic is highly adhesion to most used materials for piping manufacture, this allows to use it effectively for protection of pipes from the environmental impact.

TSM Ceramic, alternatively to conventional insulation «wrapping materials» (polyurethane foam, mineral wool), isolates safely the most complex surfaces, providing 100% adjoining to the surface, conserves un-removed rust and prevents from corrosion on the coated surface.

TSM Ceramic provides the opportunity to insulate the valves and other elements of piping systems, where the heat losses constitute about 30% .

TSM Ceramic material is applied with a painting brush or a spray, that enables to save materials while insulating different components and constructions.

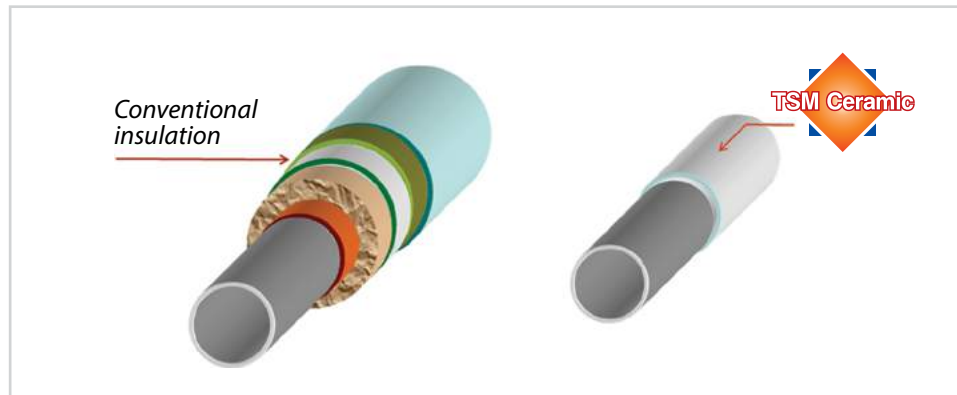


Cost Savings

1. Reduction of labour costs and time while using **TSM Ceramic** because of easy handling.
2. Reduction of costs of pipeline repair after the warranty period due to absence of need to install the old insulation and to perform preparation works to isolate the old piping.
3. Reduction of costs for heat energy saving in the pipes, steam boilers, etc. due to **TSM Ceramic** high thermal insulation characteristics and complete insulation of pipes, steam boilers, valve, adapters, etc., even in the most hard-to-get-at places.
4. Possibility of **TSM Ceramic** applying directly to the hot surface without interrupting the work of the heating system or the steam boiler.
5. Reduction of costs for thermal insulation installation by decreasing the number of technological operations connected with heat insulation of pipelines etc. while applying **TSM Ceramic** as the insulation.
6. Reduction of costs of pipeline repair in case of emergency situations by decreasing the search time of a leak, a hole, and the installation of the old insulation is absent.
7. Reduction of costs for heat repairs by increasing the warranty period in comparison with ordinary insulations.
8. There are no costs for the insulation rebuilding due to impossibility of its secondary use. VANDAL RESISTANT.



Insulation of steam lines and pipelines



Insulation of piping and equipment



Elimination of condensate using TSM Ceramic



Petroleum Industry

TSM Ceramic can be successfully used for thermal insulation of pipelines for transportation of oil and gas on land and underground. At the same time the cost work performed with usage of **TSM Ceramic** material on the isolated object is 30% cheaper in comparison with mineral wool and polyurethane foam.

The second saving is reduction of energy losses during operation of the objects – up to 40%. So far, **TSM Ceramic** has proved its reputation at the objects of the following companies: «Gazprom», «Rosneft», «Lukoil».

Thermal insulation of water tanks and oil using TSM Ceramic



A lot of tanks and a huge number of pipelines are insulated every year under the technology of **TSM Ceramic**. All of them are of high quality and durability.



Engineering

TSM Ceramic is used for thermal insulation of wagons, locomotives.

Insulation of locomotive cabs and wagons



Shipbuilding

In shipbuilding material TSM Ceramic are used for thermal insulation of cabins, internal corridors of vessels, waterproofing.

Insulation of hulls, internal parts of vessels



Advantages of TSM Ceramic over standard insulation

1. Highly resistant to precipitation and temperature extremes.
2. Highly resistant to impact of solar emission and radiation.
3. Record low thermal conductivity coefficient.
4. Durable - 10 years warranty, over 20 years of useful lifetime while external using.
5. High degree of adhesion.
6. The material obtains anticorrosion and waterproof properties.
7. High operating temperature: from -60°C to +260°C.
8. Work on insulation is not labour-intensive.
9. Repair work and leak detection are easy to perform.
10. Resistant to mechanical damages.
11. Possibility of usage the insulation on pipelines and objects with complex configuration and in hard-to-get-at places.
12. Eco-friendly and fireproof material.
13. The cost and time of applying works are 30% less in comparison with conventional thermal insulation.





Economic efficiency of TSM Ceramic

The following data on the economic efficiency of the material was obtained, for example:

- In 2009 in Krasnoyarsk there was insulated a facade of five-storied building, located at the address: 25Svetlov str. The thickness of **TSM Ceramic** layer was 1 mm. In the result of this house operation in 2009-2012, it turned out that we had managed to reduce heat consumption by 20%. Payback period of the project constituted 3 years.
- **TSM Ceramic** material was awarded with the second prize in St. Petersburg for the best innovative project of removing the ice from roofs of houses in 2010. **TSM Ceramic** material reduces heat losses from the roof constructions up to 80%, that in its turn, prevents the formation of ice and icicles there.



TSM Ceramic has passed all certification tests and has proved its high efficiency.

TSM Ceramic was tested in different research institutes during 2003 – 2012. In the result of the tests material specifications, established by the manufacturer, were confirmed.

TSM Ceramic material was tested at energy-intensive enterprises, power facilities, housing and utilities enterprises. According to the results of tests and measurements at the building envelopes of constructions and structures, as well as at the different thermal equipment, changes of thermal resistance to heat transfer of the building envelope by minimum 18% with material applying of 0.52 mm in thickness, were confirmed. In 2009 tests of the Research Institute of «Structural Physics» and State Unitary Enterprise «Moscow Scientific Research and Project Institute of Housing Services» showed: if **TSM Ceramic** material is applied on outside facade of 1 mm in thickness, thermal resistance of building envelopes to the value of control building envelope increased by 30.5 % and consumption of a heat-transfer agent decreased by 55 %.

In 2009 «Testing Centre VNIIGS» JSC, St. Petersburg set the term of durability of **TSM Ceramic** coating for 30 years.

Since March 2009 to February 2011 **TSM Ceramic** was tested in the following research institutes: the department of construction chemicals of Scientific and Research Republican Unitary Construction Enterprise «Institute BelNIIS»; Research Institute of Fire Safety and Emergencies of Byelorussia; Department of heat and mass transfer processes in engineering systems of Republican Unitary Enterprise «Institute of Housing - NIPTIS named after S.S. Ataev». Works on the theme: «Development and introduction of the determining methods of thermal conductivity of the thermal hyperfine insulator **TSM Ceramic**» were conducted in the «Siberian Federal University» (INSTITUTE OF FUNDAMENTAL RESEARCH) in 2011-2012.

As a result, it was recommended to accept the coefficient of thermal conductivity 0.0016-0.0019 W/m°C with 0.5-1.5 mm in thickness for engineering calculations of thermal technical characteristics of **TSM Ceramic** coatings.

Technical approval for usage of **TSM Ceramic** insulating material in construction industry was received according to the results of conducted tests.

TSM Ceramic material is fully certified, obtains four patents and technical approval.



TSM Ceramic obtains all required technical documentation, certificates and technical approval.

- Eurasian Patent No. 013735
- Invention Patent No. 2430792
- TA 05.0172.12
- Conformity Certificate No. POCC RU.AE95.H01852
- Conformity Certificate No. PCC RU.CF64.H00025
- Fire Certificate No. C -RU.ПБ24.В.00354
- Hygienic Certificate – No. 77.01.03.570.П.0650800808
- Hygienic Certificate No. 34.77.03.570.П.0038280906
- Hygienic Certificate No.№ 77.ТУ.05.576.П.0001000907
- Russian Technical Expertise Centre CTO-CA-03-002-2009
- Russian Building Certification. TO-H00025-07
- Experimental Centre «All-Union Scientific Research Institute of Hydro mechanization of Sanitary-engineering and Special Construction Works» No.270-1-09
- Russian Technical Supervision Service «Centre of Laboratory Analysis and Technical Metrology» T3 2007
- State Unitary Enterprise «Moscow Scientific Research and Project Institute of Housing Services» T3 2009
- Institute for Scientific Research of Building Constructions T3 2005

Our partners:

- «Russian Railways» PJSC
- «Gazprom» PJSC
- «Rosneft» PJSC
- «Tatneft» PJSC
- JSC «Rosatom»
- JSC «Rosgidro»
- JSC GC «E4»
- and others.

We highly appreciate your cooperation!

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