



## HEAT-RESISTANT MATERIAL SERIES LOSSNA-BOARD

High-performance heat insulating board which displays the excellent characteristics on any condition.



Specifications for LOSSNA-BOARD		
Max.thickness	Min.thickness	Material dimension
40mm	1mm	1,000mm × 1,000mm 1,000mm × 1,200mm 1,000mm × 1,250mm

Excellent heat resistance.  
Outstanding dimensional stability.  
Superior resistance to compression.  
Compressive creep characteristics which minimize deformation due to continuous use for a long time.  
High-grade arc resistance.

While general heat insulating materials withstand temperatures approximately 200°C, LOSSNA-BOARD, high-performance heat insulating material, insulates continuously even at a temperature of 400°C. Stable insulation can be attained in any heated area such as electric furnaces and drying ovens for which any conventional heat insulating material is used.

LOSSNA-BOARD also has outstanding "Dimensional stability". Today, high accuracy is required in every field of industry. LOSSNA-BOARD is highly reliable heat insulating material that minimizes thermal expansion and deformation due to pressure strain and continuous use. Excellent performance has been proven in every industrial field as an insulating material for high-temperature and high-precision forming machines for super engineering plastics, IC components, vibration-proofing rubber, and oil seal components.

### Optional Specifications

LOSSNA-BOARD of special specifications, which heat resistance has been further improved (500 to 800°C).

Physical Properties of LOSSNA-BOARD			
Test Items		Unit	
Heat resistance			400
Flexural strength	Vertical to laminations	MPa	147
Compressive strength	Vertical to laminations	MPa	441
	Parallel to laminations	MPa	98
Izod impact strength		J/cm	2.9
Cleavage strength		kN	3.1
Water absorption		%	0.05
Thermal conductivity		W/m · K	0.24
Coefficient of thermal expansion	Vertical to laminations	1/	$2.6 \times 10^{-5}$
Specific gravity			2.0
Flatwise withstand voltage (1 min.)		kV/mm	10
Insulation resistance	Normal state	M	$1.0 \times 10^8$
	After boiling	M	$2.0 \times 10^3$
Arc resistance		sec	345

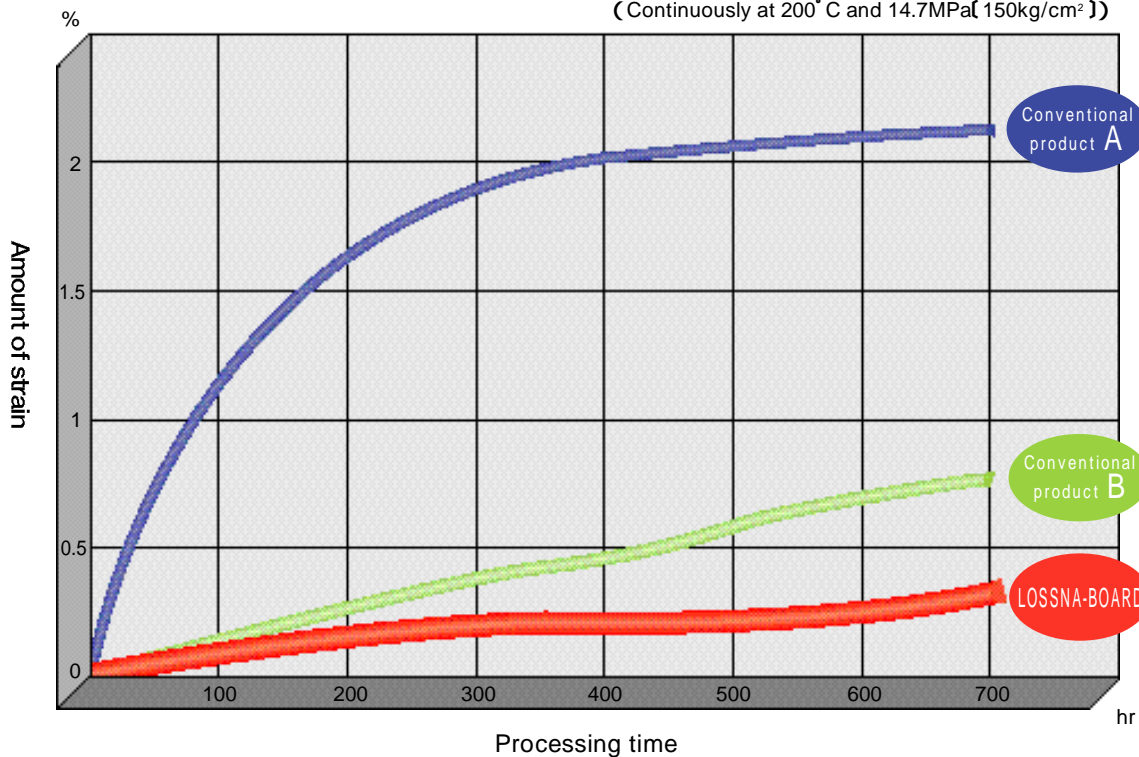


Mold for semiconductor sealing



Heat insulating material for forming machine

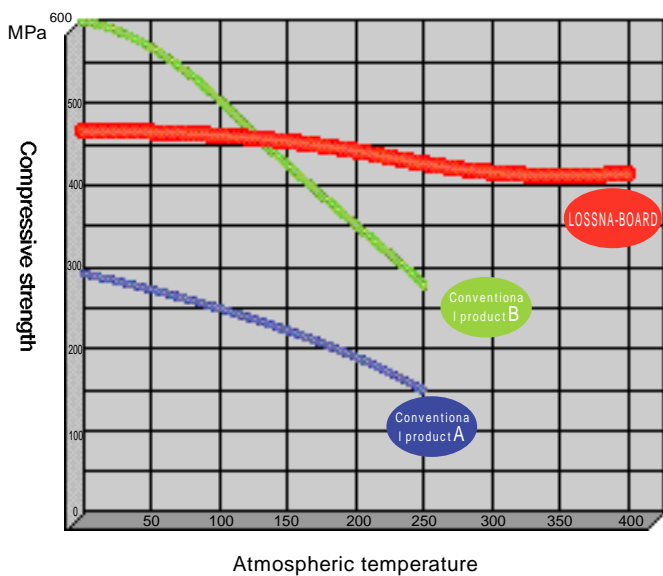
(Continuously at 200°C and 14.7MPa[ 150kg/cm<sup>2</sup> ])



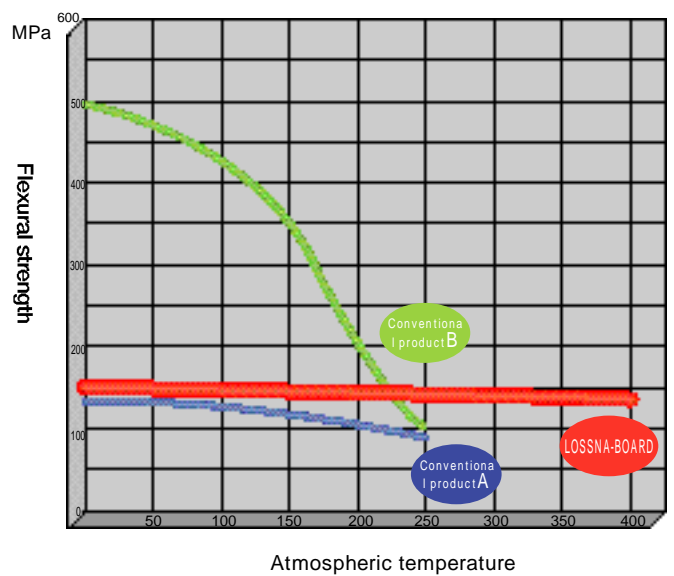
Compressive creep characteristics

This chart shows the influence of compressive force for a long time in the heating atmosphere. Even the conventional products "A" and "B", which are regarded as excellent insulation materials with considerable heat resistance, deform remarkably as time passes. LOSSNA-BOARD displays an outstanding stability against pressure and temperature applied continuously for a long time.

Compressive strength upon heating



Flexural strength upon heating





HEAT INSULATING MATERIAL SERIES

## BESTHERMO SERIES

Multifunctional heat insulating material series seeking further functions.



Specifications for BESTHERMO			
	Max.thickness	Min.thickness	Material dimension
F	30mm	1mm	1,000mm × 1,000mm 1,000mm × 1,200mm 1,000mm × 1,250mm
S	30mm	1mm	
H	20mm	1mm	
U	40mm	1mm	

High strength characteristics proof against bending and compression.

Excellent chemical resistance.

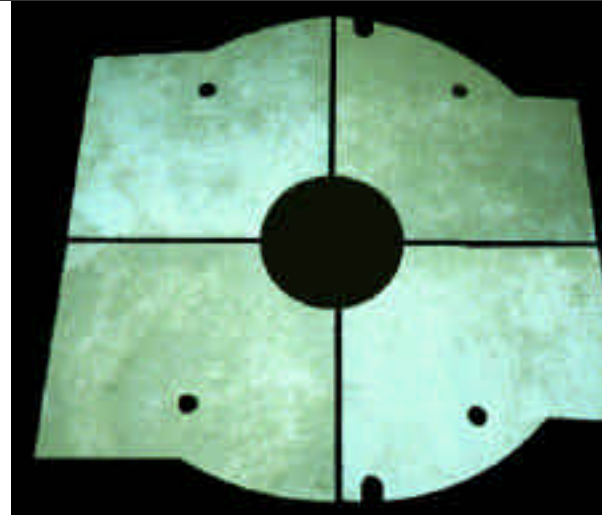
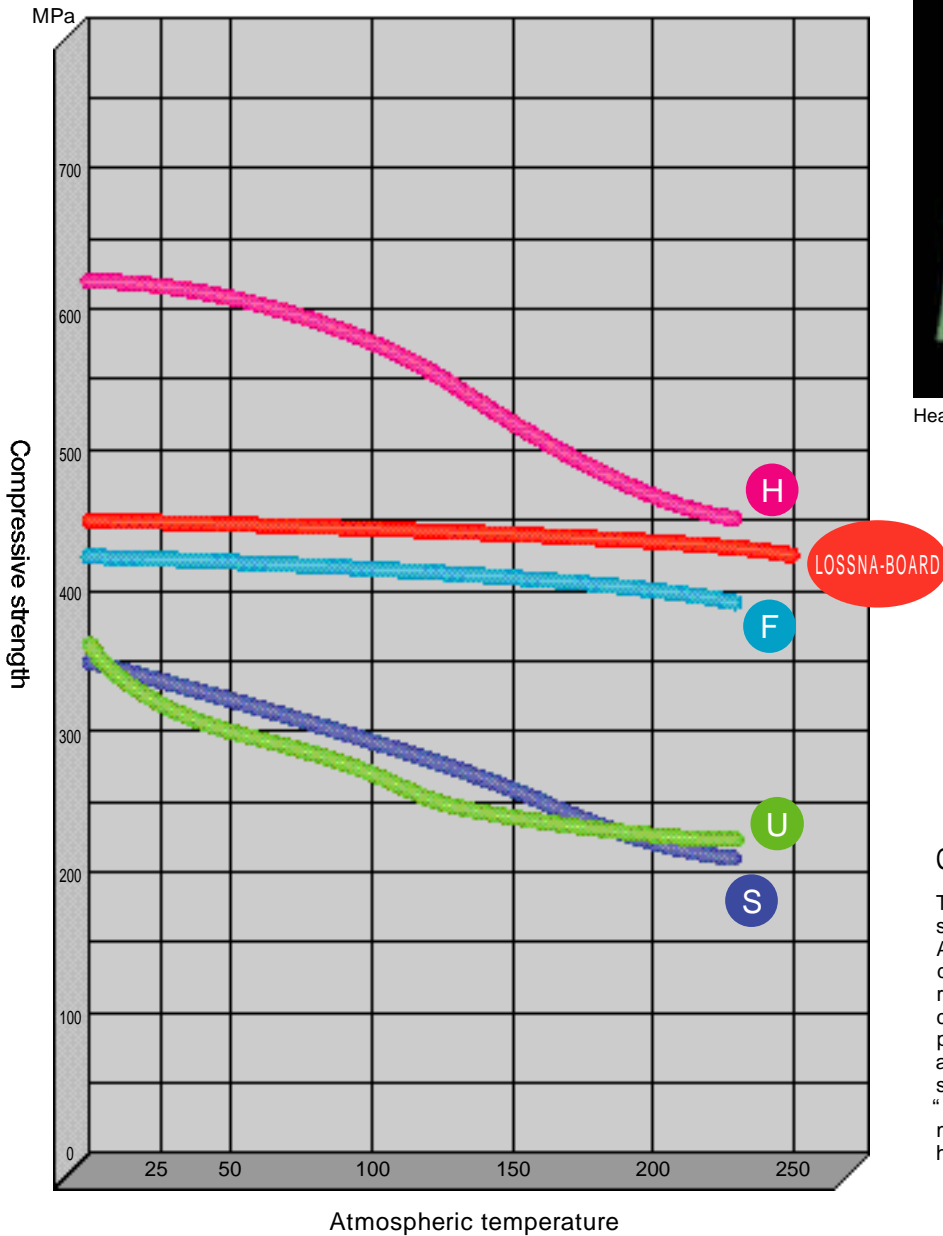
Superior insulation effectiveness.

Minimizes permanent strain.

Economical efficiency with quality results.

BESTHERMO series is a distinctive, general-purpose and multifunctional heat insulating material. In addition to the basic insulative properties, various kinds of properties such as "Dimensional stability" "Shock resistance" "Durability" and "Workability" have been developed. Consequently, you can make your best choice from our lineup according to your application and purpose. The greatest feature of BESTHERMO series is "Economical efficiency", which offers the excellent properties at a reasonable cost. The heat insulation material with both "Functionality" and "Economical efficiency" BESTHERMO series of Nikko Kasei.

Physical Properties of BESTHERMO Series						
Test Items	Unit	BESTHERMO-F	BESTHERMO-S	BESTHERMO-H	BESTHERMO-U	
Heat resistance		300	250	300	200	
Flexural strength	Vertical to laminations	MPa	189	159	464	197
Compressive strength	Vertical to laminations	MPa	406	319	584	335
	Parallel to laminations	MPa	148	113	365	170
Izod impact strength		J/cm	3.7	4.8	6.6	3.8
Cleavage strength		kN	3.6	3.5	9.4	5.8
Water absorption		%	0.07	0.03	0.01	0.10
Thermal conductivity		W/m · K	0.24	0.21	0.23	0.23
Coefficient of thermal expansion	Vertical to laminations	1/	$5.2 \times 10^{-5}$	$6.5 \times 10^{-5}$	$4.0 \times 10^{-5}$	$4.9 \times 10^{-5}$
Specific gravity			2.0	1.8	2.0	1.9
Flatwise withstand voltage (1 min.)		kV/mm	10	10	15	10
Insulation resistance	Normal state	M	$2.5 \times 10^8$	$2.2 \times 10^8$	$5.0 \times 10^8$	$1.4 \times 10^8$
	After boiling	M	$2.0 \times 10^4$	$3.2 \times 10^3$	$1.0 \times 10^5$	$1.0 \times 10^4$
Arc resistance		sec	320	250	180	155



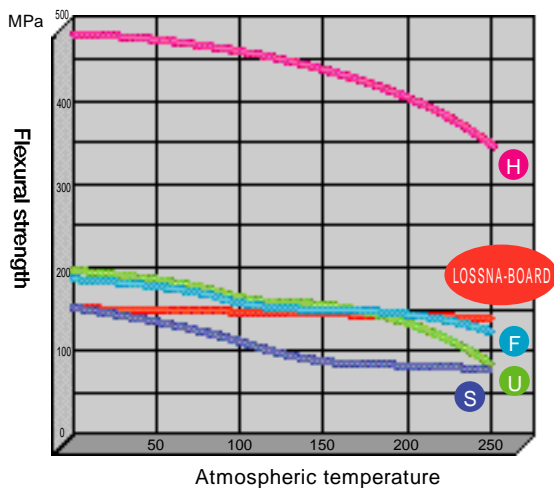
Heat insulating material for tire press

Compressive strength upon heating

This chart shows the compressive strength in a heated atmosphere. Although heat insulating materials display good compressive strength, reliability of heat insulating material cannot be kept unless good compressive strength can be maintained at a high temperature. "Compressive strength upon heating" as well as "Creep characteristics" is one of the most important elements in selecting high strength heat insulating materials.

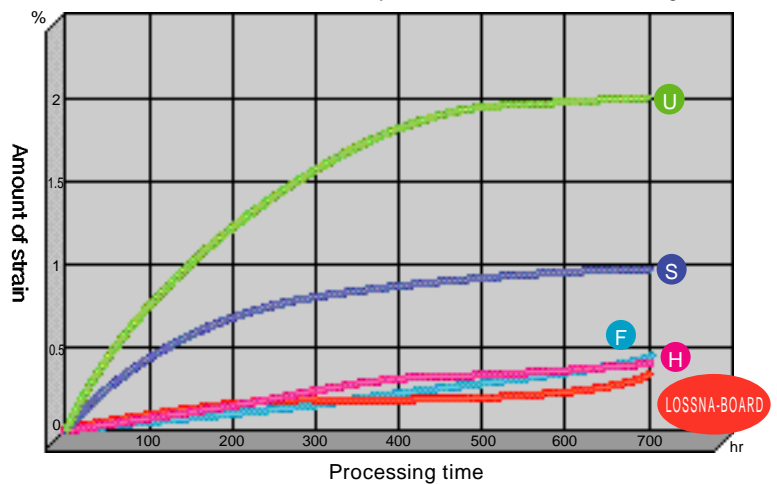
Flexural strength upon heating

The chart below shows general mechanical strengths. BESTHERMO series display steady strength even when irregular force (bending force) is applied at a heated temperature of 250.



Compressive creep characteristics

(Continuously at 200°C and 14.7MPa [150kg/cm²])

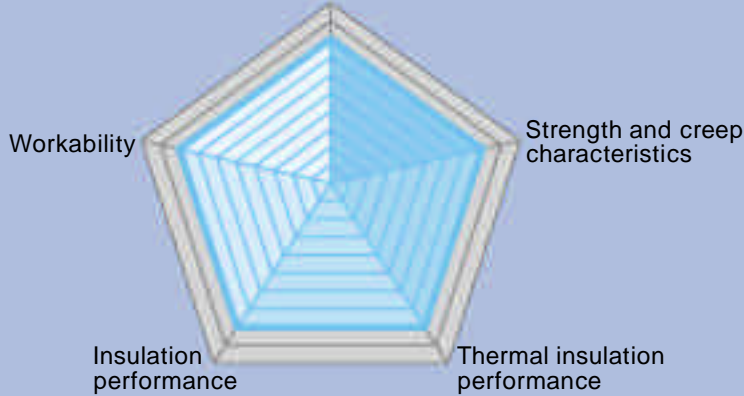


# BESTHERMO-F

BESTHERMO-F, an economical version of LOSSNA-BOARD, has excellent heat resistance and anti-compressive creep characteristics.



Heat resistance performance



**Features**

Low thermal conductivity.  
Excellent arc resistance and tracking resistance.  
Low water absorption capacity and low hygroscopic properties.  
Passes the automotive material combustion test UL-94V-0.  
Excellent heat shock resistance.

**Application**

Heat insulating material for high-temperature forming machines.  
Heat insulating material with arc resistance, high frequency insulation properties and dielectric characteristic.  
Automotive heat insulation.

BESTHERMO-F  
Rubber vulcanization press molds

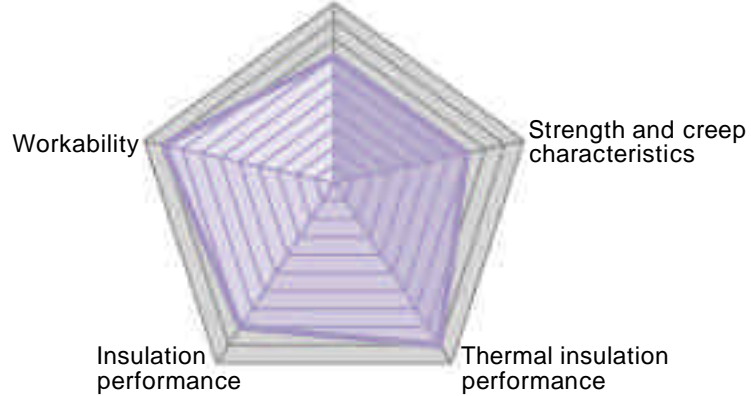


# BESTHERMO-S

Among this series, BESTHERMO-S has the lowest thermal conductivity and an excellent thermal insulation performance suitable at a high temperature. It also has excellent high frequency properties.



Heat resistance performance



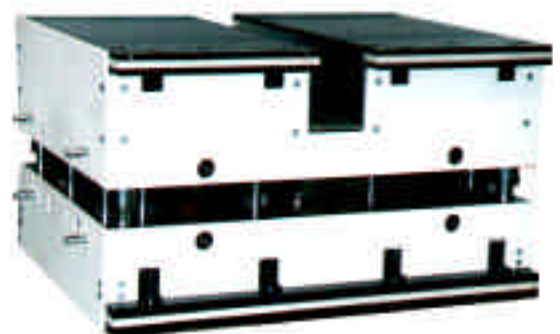
**Features**

Thermal insulation with considerably low thermal conductivity.  
Insulation with excellent dielectric characteristic.  
Flexible workability.

**Application**

Heat resistant material for high temperature and intermediate pressure forming machines.

BESTHERMO-S  
Mold for IC sealing

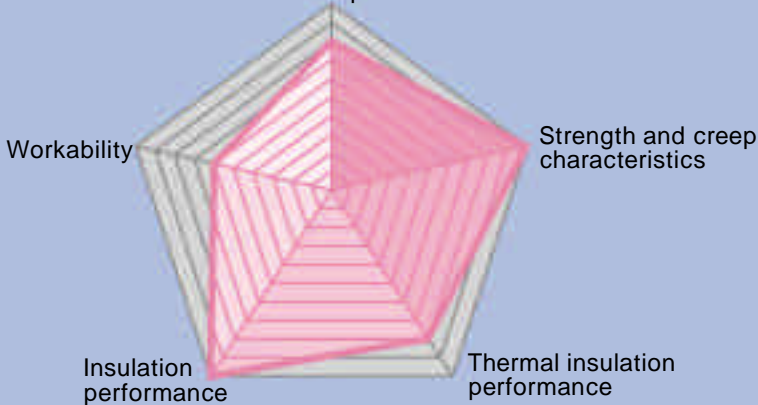


# BESTHERMO-H

BESTHERMO-H is the most durable in this series of strong, low thermal conductive and heat resistant materials. Its best application is heat insulation material and structural material in high temperature areas.

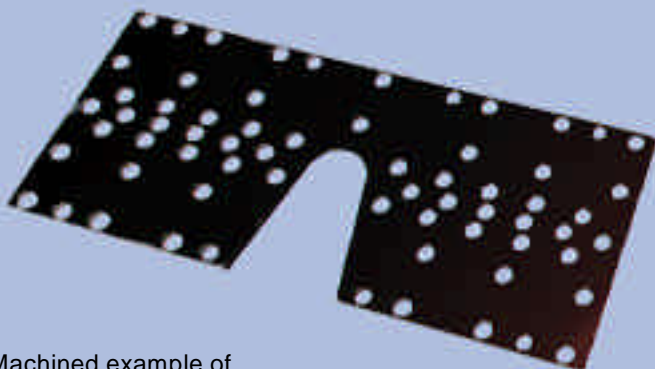


Heat resistance performance



- Features**
  - Outstanding strength withstanding " Bending " and " Compression ".
  - Low creep characteristics suitable for long-term use.
  - Superior izod impact strength.
  - High voltage insulation.
  - Excellent dimensional stability.
  - Flexible workability.

- Application**
  - Heat insulation material for high temperature.
  - Insulation material for high-precision forming machine.
  - Structural material with strength at a high temperature.



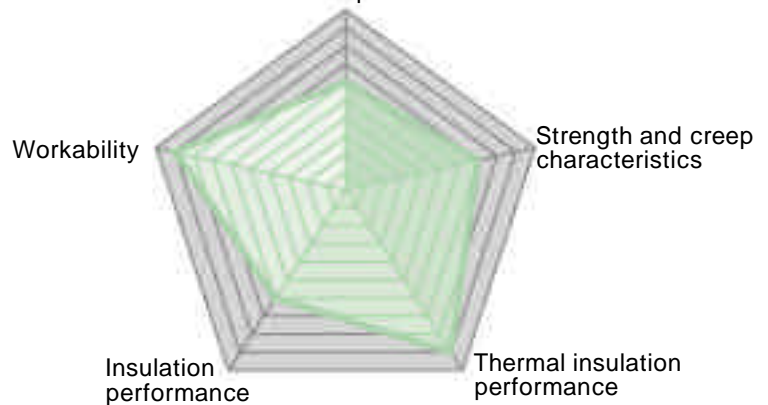
Machined example of BESTHERMO-H

# BESTHERMO-U

The most economical material of this series, which has every physical property as heat insulating application like low thermal conductivity. We are sure that remarkable effect can be achieved even under cost restrictions.



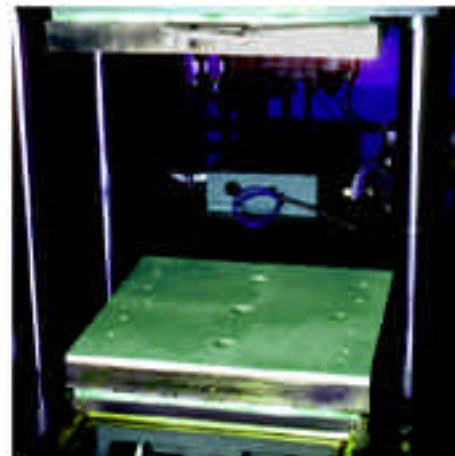
Heat resistance performance



- Features**
  - Thermal insulation with considerably low thermal conductivity.
  - Low creep characteristics suitable for long-term use.
  - Reasonably priced to meet your industries' expectations.
  - Excellent workability available in wide range.

- Application**
  - Heat insulation material for intermediate temperature and intermediate-pressure forming machines.
  - Heat insulation material for restricted budgets.

Example of application of BESTHERMO-U.





LIGHTWEIGHT MATERIAL SERIES

## KALLYTE SERIES

Lightweight and heat-resistant insulation material seeking "Profitability" through "Lightweight"



KALLYTE floating on water

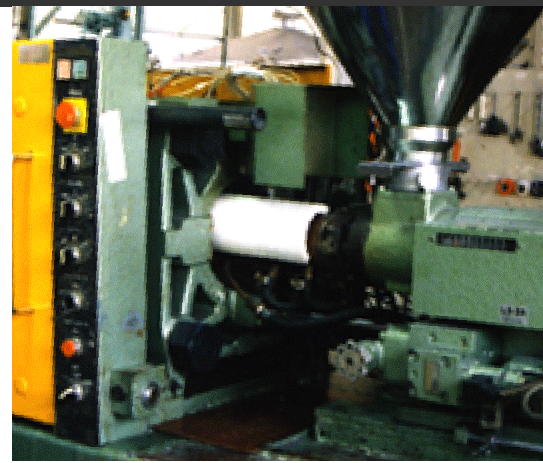
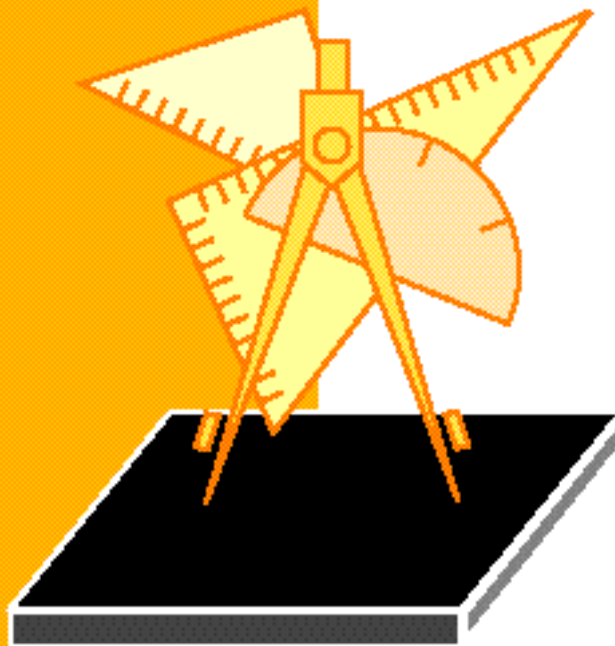
Specifications for KALLYTE series		
Max.thickness	Min.thickness	Material dimension
50mm	3mm	1,000mm x 1,000mm

Ultra-light heat-resistant insulating material. Excellent heat retaining properties with low thermal conductivity. Outstanding strength withstanding " Bending ", " Compression " and " Izod impact tests ".

Lightweight and heat insulation produce profitability. Nikko Kasei has been paying attention to economics brought on by lightweight materials. It has been our subject of research for a long time. We manufacture lightweight heat-resistant board without sacrificing heat retaining properties, insulation or heat resistance.

KALLYTE, is half the weight of conventional laminated materials. Although it has the heat resistance, insulation performance and durability equal to other laminated materials, we have developed a lightweight energy efficient heat retaining insulation therefore, reducing kinetic energy cost. Having been highly evaluated for its lightweight and insulating properties, KALLYTE EGL is standard material on " Nozomi " and any other next generation Super-express trains in Japan. KALLYTE IGL is expected to be widely used for side panel heat-retaining material for diecasting and insulation material for machine tools because of its excellent heat-resistance, high-strength heat-retaining/insulating and lightweight properties.

Physical Properties of KALLYTE Series					
Test Items	Unit	IGL-14	EGL-10	EGL-14	
Heat resistance		400	180	180	
Flexural strength	Vertical to laminations	MPa	128	196	335
Compressive strength	Vertical to laminations	MPa	228	223	294
	Parallel to laminations	MPa	80	174	235
Izod impact strength		J/cm	4.6	5.0	5.3
Cleavage strength		kN	2.6	8.3	7.8
Water absorption		%	0.09	0.08	0.05
Thermal conductivity		W/m · K	0.09	0.08	0.09
Specific gravity			1.4	1.0	1.4
Flatwise withstand voltage (1 min.)		kV/mm	10	10	15
Insulation resistance	Normal state	M	$1.0 \times 10^7$	$1.0 \times 10^7$	$2.5 \times 10^7$
	After boiling	M	$2.0 \times 10^3$	$1.0 \times 10^3$	$2.5 \times 10^3$
Arc resistance		sec	250	90	123



Cylindrical heat insulator for forming machine.

LIGHTWEIGHT MATERIAL SERIES

# KALHON-L

General-purpose heat-resistant material with flexible workability

- General purpose with flexible workability
- Superior heat insulation
- Excellent durability at high temperatures
- Ultra-light board

Demands for heat insulation and heat retention are being diversified. To meet such demands, heat retaining and insulation materials must have flexibility as industrial materials. KALHON-L of Nikko Kasei has achieved this from plate structure to cylindrical shapes, plus excellent workability with density control, integral construction and lamination. KALHON-L was also developed as heat-resistant, heat-retaining and heat-insulation material with high performance.

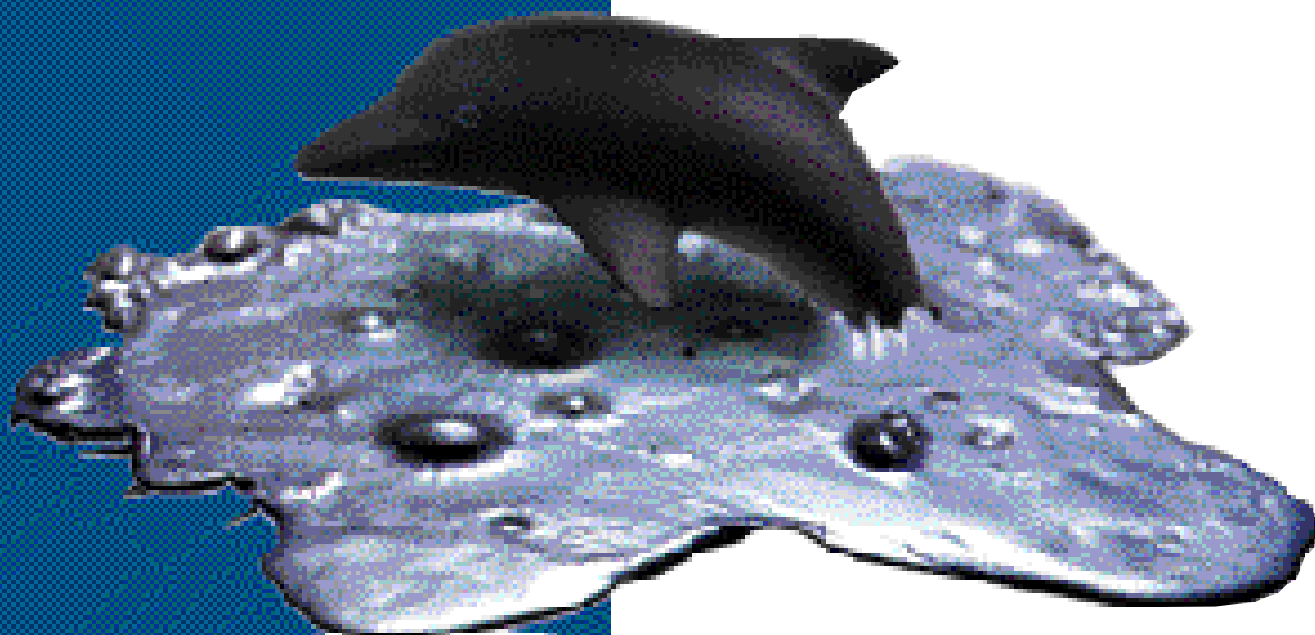
In addition to its workability, KALHON-L has low thermal conductivity  $0.077\text{W/m}\cdot\text{K}$  and durability at a temperature of  $500^\circ\text{C}$ , KALHON-L is being applied in many areas such as " mold heat retaining material ", " heat insulation material for high-temperature facilities ", " heat-retaining plates in heating elements ", and " material for dew condensation prevention ", etc.



Specifications for KALHON-L	
Thickness	Material dimension
10mm 20mm 30mm	1,000mm x 1,000mm

Physical Properties of KALHON-L			
Test Items		Unit	
Heat resistance			500
Flexural strength	Vertical to laminations	MPa	8.9
Izod impact strength		J/cm	1.2
Water absorption		%	6.3
Thermal conductivity		W/m · K	0.077
Coefficient of thermal expansion	Vertical to laminations	1/	$7.4 \times 10^{-5}$
	Parallel to laminations	1/	$3.1 \times 10^{-5}$
Specific gravity			0.5
Arc resistance		sec	250





HEAT-RESISTANT MATERIAL SERIES

# T-MOLD

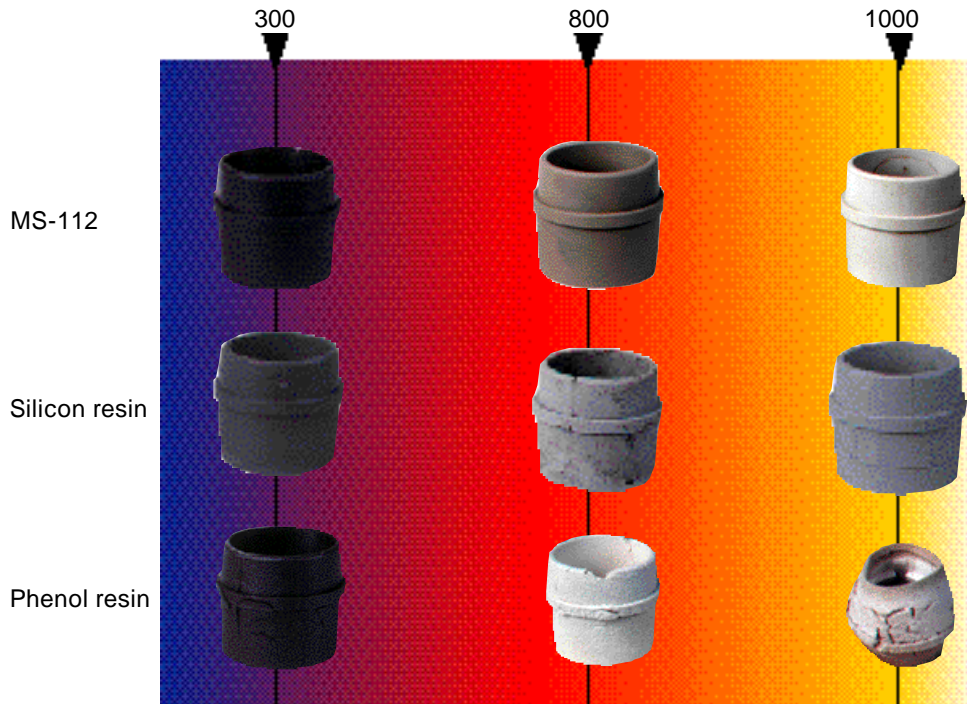
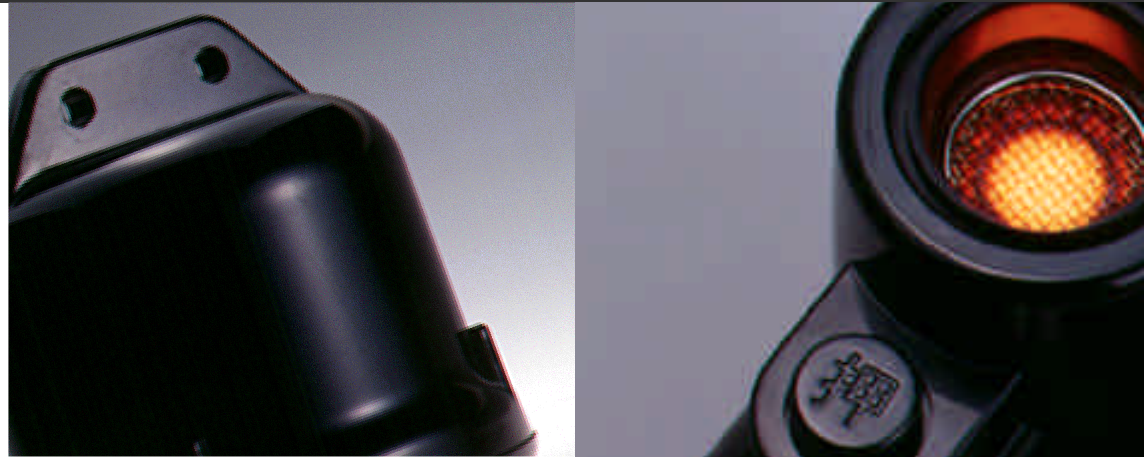
New forming material with excellent heat resistance, dimensional stability, insulation property and arc resistance.

Heat resistance equivalent to ceramics.  
 Excellent insulation properties  
 Low coefficient of linear expansion.  
 Flexible and strong.

“ T-MOLD ”is a thermosetting super heat-resistant forming material developed by concentrating the advanced electrical insulation technology and forming technology of Nikko Kasei. “ T-MOLD ”is quite a new industrial material that has excellent workability like that of organic resins and its heat resistance is equivalent to that of ceramics. “ T-MOLD ”is expected to be used in various fields such as “ heat-resistance articles instead of metal or ceramics ”, “ arc chute ”, “ breaker ”, “ welded components ”, “ heavy electrical components in microwave ovens ”, and “ components related to semiconductor devices ”, etc.



Physical Properties of T-MOLD				
Test Items	Unit	MS-112	MP-114	MI-118
Specific gravity	-	1.90	1.90	1.90
Water absorption	%	0.04	0.04	0.12
Thermal deformation temperature		300 <	300 <	300 <
Coefficient of linear expansion.	1/	$4.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	$1.5 \times 10^{-5}$
Thermal conductivity	W/m · K	0.66	0.52	0.56
Coefficient of contraction upon forming	%	0.2	0.2	0.05
Insulation resistance	Normal state	$4.0 \times 10^{15}$	$2.0 \times 10^{14}$	$1.0 \times 10^{15}$
Insulation resistance	After boiling	$5.0 \times 10^{13}$	$6.0 \times 10^{12}$	$2.0 \times 10^{13}$
Withstand voltage	kV/mm	12	12	12
Arc resistance	SEC	310	242	85
Tracking resistance	V(CTI)	600 <	200	200
Dielectric constant (MHz)	-	4.0	4.6	4.6
Dielectric loss tangent (MHz)	-	0.002	0.015	0.015
Flexural strength	MPa	60	170	120
Bend elastic constant	MPa	9,800	17,700	14,700
Tensile strength	MPa	40	60	60
Izod impact strength	J/m	0.39	0.85	0.36
Flammability	-	Equivalent to V-0		



The outstanding heat resistance of T-MOLD

Resin-based heat-resistant materials are generally used in various fields because of their manageability and low cost. These materials, however, have not reached to satisfactory level in terms of heat-resistant ability. During long-term continuous heat resistance testing, the upper limit temperature of most resin-based heat-resistant materials was approximately 200 to 300 at the high end. T-MOLD MS-112 shows excellent heat-resistance during long-term testing at 300. Though it is hard to tell the difference among the materials at 300, T-MOLD, retaining its original form, clearly displays heat-resistance at 800 to 1,000.

## BASIC SERIES

Three types of BASIC series display every feature effectively. Use suitable one as necessary.

### OPTION

Custom-made T-MOLD, is available based on your ratio factor requirements. Through integrated production from constituent blending and forming, we are willing to meet your any special request, e.g., high conductivity, minimization of abrasion, etc. For details, please feel free to contact us.

### MS series

Heat-resistance (300 to 500 )

Stabilized structure even at a high temperature of 1,000 .

Contains no heavy metal nor asbestos for environment preservation.

Weather resistance against ultraviolet rays, etc.

Low dielectric constant, low dielectric loss tangent and many other excellent electrical characteristics.

Formed by injection, transfer and compression.



### MP series

Heat-resistance (200 to 300 )

Excellent stability against every kind of solvent.

Excellent electrical insulation.

Formed by injection, transfer and compression.



### MI series

Heat-resistance (200 to 300 )

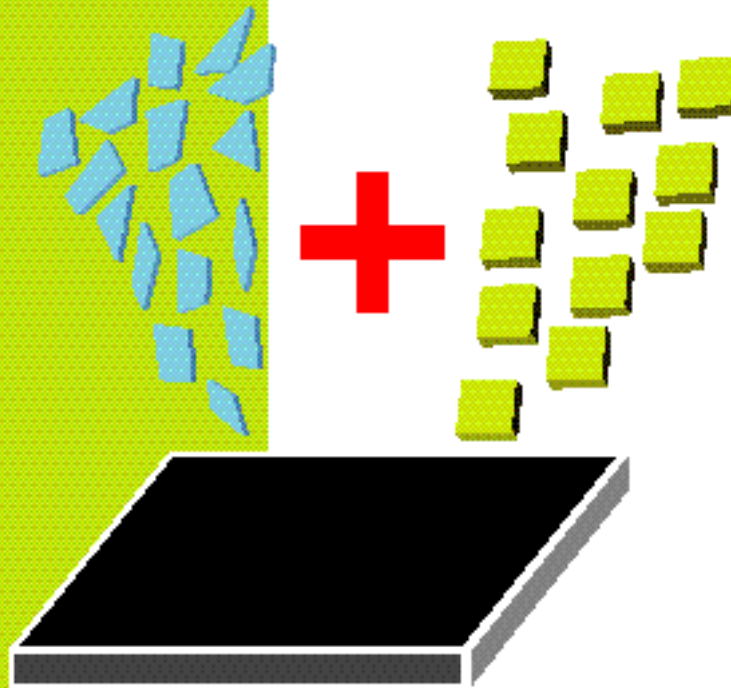
Excellent radiation resistance.

Superior dimensional stability when heated.

Chemical resistance against acid, alkali, etc.

Formed by transfer and compression.





## HEAT-RESISTANT MATERIAL SERIES **MICALEX**

Advanced-technology material. Machineable ceramics made from natural mica, artificial mica and special glass with hot forming.

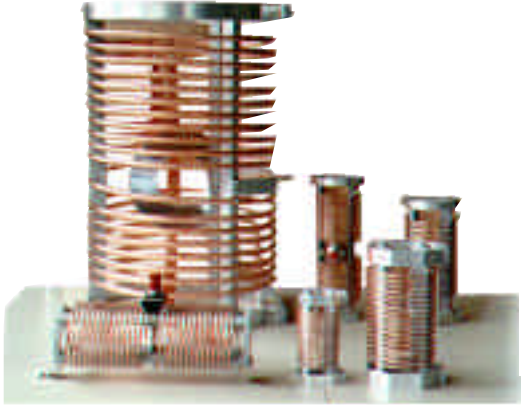


Specifications for MICALEX			
	Max.thickness	Min.thickness	Material dimension
M-31 (Natural mica)	35mm	3.2mm	300 × 300mm 280 × 500mm
M-25 (Artificialmica)	35mm	3.2mm	290 × 340mm

- Excellent electrical insulation.
- Excellent high frequency properties.
- Heat, pressure and arc resistance.
- Superior workability.
- Excellent dimensional accuracy and form-stability.

Today, heat-resistance materials play an important role in semiconductor which is the core of our computer world. MICALEX is on the cutting edge of heat-resistance material technology by minimizing the generation of gas caused by the corrosion of glass material at a temperature of 700 .With its excellent accuracy and stability, MICALEX is behind the scenes supporting the microchip industry.

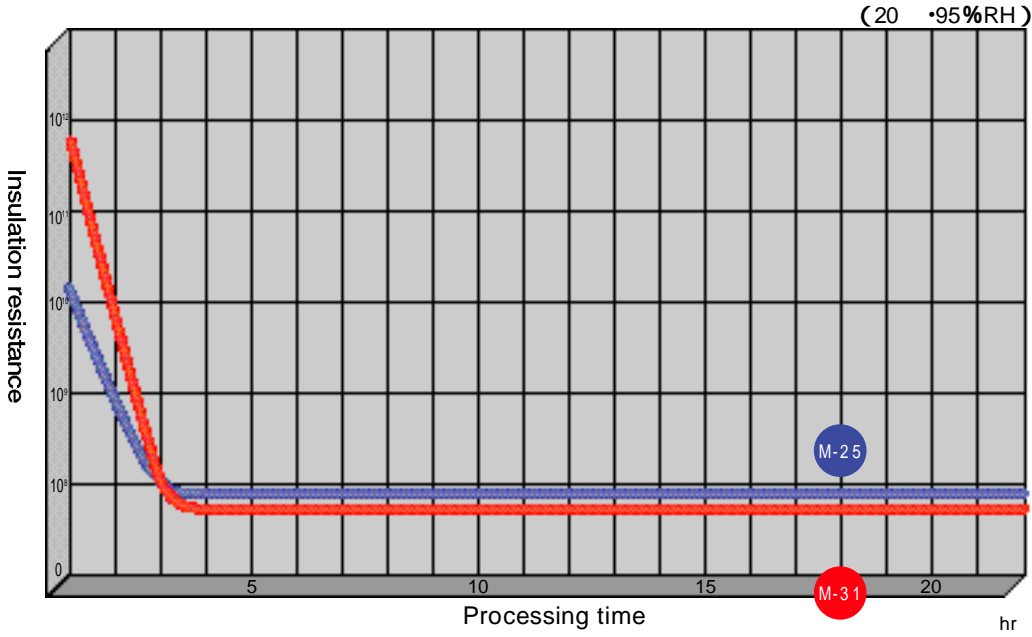
Physical Properties of MICALEX			
Test Items	Unit	M-25 (Artificial mica)	M-31 (Natural mica)
Heat resistance		700	400
Flexural strength	MPa	73	108
Compressive strength	MPa	216	226
Tensile strength	MPa	148	115
Izod impact strength	J/cm	0.4	0.6
Water absorption	%	0.002	0.005
Thermal conductivity	W/m · K	1.42	1.24
Coefficient of thermal expansion (Vertical to laminations)	1/	$7.0 \times 10^{-6}$	$9.0 \times 10^{-6}$
Specific gravity		2.5	2.6
Withstand voltage (1 min.)	kV/mm	10	15
Volume resistivity	J · cm	$1.9 \times 10^{14}$	$2.0 \times 10^{14}$
Insulation resistance	M	$2.2 \times 10^5$	$2.5 \times 10^5$
Arc resistance	sec	420	246



Example of application in a heater

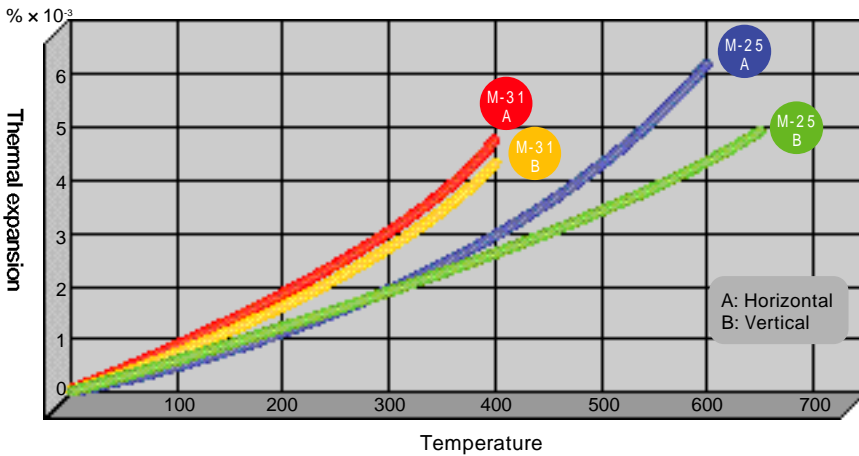


Machined example of MICALEX



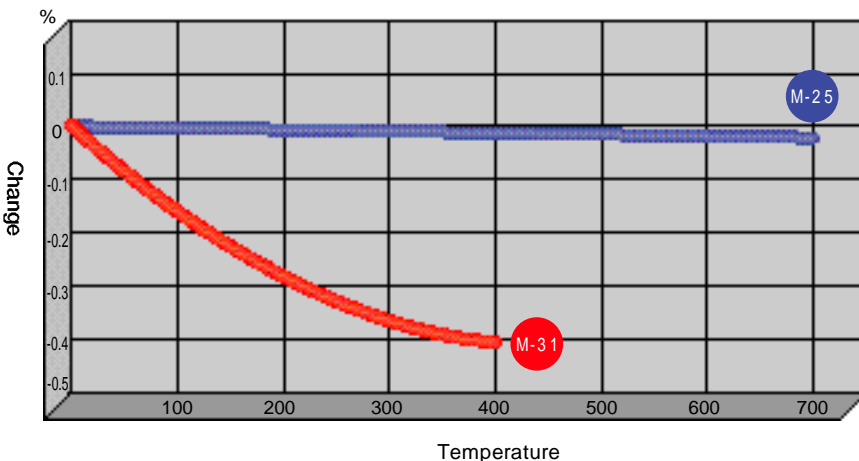
Insulation resistance in high humidity.

The chart on the left shows the transition of insulation resistance as time passes in 95% humidity. MICALEX has high insulation performance even in high humidity and displays excellent water and oil resistance.



Thermal expansion curve

Thermal expansion is minimized, strain and distortion are prevented well with MICALEX. It can maintain excellent dimensional accuracy even at high temperatures. MICALEX displays a special ability as a component of devices related to semiconductors and heat-resistant materials for heaters.



Change in weight upon heating

Upon heating matter, organic substances are burned and they loose weight. MICALEX is composed of an inorganic substance. M-31 is made from natural mica and, therefore, it shows greater changes of weight compared with M-25.

# What is heat insulating materials?

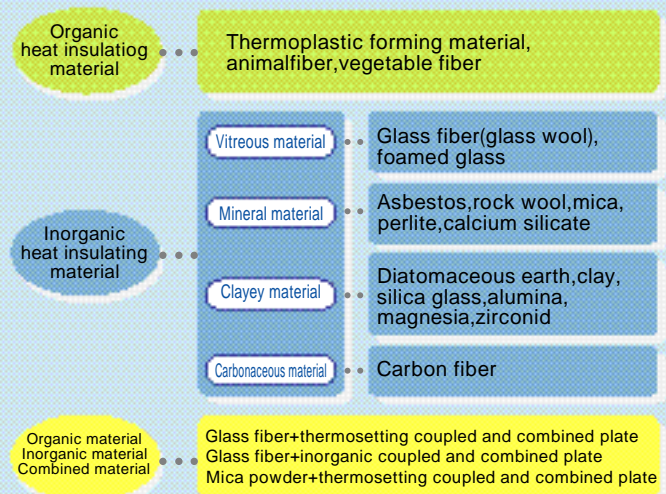
"Heat insulating material" means a material to insulate heat literally. Utilization of heat insulating material is spreading over various fields from ultra-low temperature applications (−253 °C) of using liquid hydrogen for fuel to high temperature applications (above 2,000 °C) of nuclear reactors. Why do such various fields demand heat insulating materials? It is because the safety and productivity improved by the heat insulating materials are necessary for today's industry. It is widely recognized that remarkable economic results, improvement of product accuracy as well as productivity, reduction of energy cost on the production line, comfortable working environment and minimization of deformation which are all attributed to heat insulation. An increasing number of industries are expecting more effective heat insulating materials and are taking a great interest in them.

## 1 Types of heat insulating materials

Figure-1

There are three types of heat insulating materials, i.e., solid, liquid and gas, and each of them has unique characteristics. Solid heat insulating materials have various types of products that have been developed based on various materials. As shown in Figure-1, these products are classified as "organic material", "inorganic material" and "combined material" composed of organic and inorganic materials. Generally, "organic" heat-insulating materials have an advantage in workability and cost, but have problems in durability at high temperatures. On the other hand, "inorganic" heat insulating material is excellent in heat-resistance and strength, but it tends to be costly.

Nikko Kasei has been conducting diversified and multilateral researches on heat-insulating materials for a long time and pushing forward the development of more powerful and effective non-asbestos heating insulating materials.



## 2 Selection and processing of heat insulating materials

In general, materials are examined by comparing physical characteristics shown in catalogs issued by manufacturers. However, measuring methods of physical characteristics are not standard and, therefore, the values stated in the catalogs cannot be directly compared in many cases. For example, a value of thermal conductivity varies greatly depending on the measurement method. To avoid troubles in selecting materials, it is highly recommended to consult with manufacturers and processors over and over again.

In most cases, heat-insulating materials are made into flat plate and therefore, cutting, drilling, milling, tapping and polishing works are required for practical use. The dust generated in the process of such works sometimes causes environmental problems. Though Nikko's products do not contain any harmful asbestos, it is advisable to ask material processors to handle the processing works. The processors authorized by us control the dust and finish up the work with precise craftsmanship. For further information on authorized processors, please contact our dealers or our head office directly.

### Notes on handling



#### Notes on transportation

1. For heavy materials, use a suitable transportation equipment and handle with care.



#### Notes on processing

1. Install a local ventilator in places where fine chips may be produced upon processing.
2. Put on any protector to protect yourself from fine chips dispersed upon processing.

When you complete your work or leave your working area, remove the fine chips from your protector and clothes, and be sure to gargle.



#### Notes on storage

1. Select a place with low humidity that is not exposed to the sunlight.
2. Stack the products on a flat bed. If you lean them against walls, etc., support or take necessary measures to prevent them from falling.



#### Notes on scrapping

1. Take necessary measures to prevent fine chips from dispersing.
2. For disposal of cut pieces and fine chips, follow your governmental/local rules and regulations and request a qualified industrial waste treatment contractor.

# Heat-resistant board of Nikko Kasei meets the diversified needs as follows:

