

### 〈Product introduction〉

## High-strength low-thermal conductivity insulation material TOMBO™ No.4350-GH “ROSLIM™ Board GH”



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Industrial Product Division

### 1. Introduction

Our product, the high-strength low-thermal conductivity insulation material TOMBO™ No. 4350-GH “ROSLIM™ Board GH” (**Figure 1**) won Japanese Award for Chairman of Energy Saving Center in the Product/Business category of the 2015 Annual “Energy Saving Grand Prize Contest” held by General Incorporated Foundation “Energy Saving Center” (sponsored by the Ministry of Economy, Trade and Industry)

Effective usage of energy is a big challenge for the industrial sector. One of those challenges is the use of industrial thermal insulation in high temperature ranges of between 400 to 1000°C. While there are some industrial thermal insulation materials which have high thermal insulation ability, most of them have low strength, have problems in their processing capability and handling ability, so their usage has been limited.

TOMBO™ No.4350-GH “ROSLIM™ Board GH” received the award as it was recognized to have far superior thermal insulation ability than conventional thermal insulation materials, while having the strength and high workability to allow it to be easily handled by anybody.

In this report, we introduce the TOMBO™ No.4350-GH “ROSLIM™ Board GH”(Hereafter called ROSLIM™ Board GH), which has been

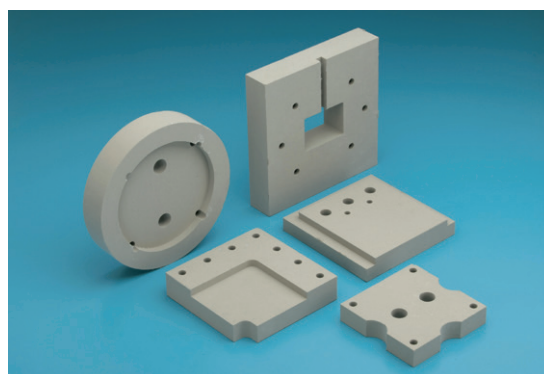


Figure 1. Finished goods made from TOMBO™ No.4350-GH “ROSLIM™ Board GH”

contributing to energy saving in high performance industrial furnaces, and space saving in private use fuel cells. It has been sold to many customers since it was released on the market due to its superior thermal insulation property, high strength, and energy saving properties.

### 2. Outline of the product

“ROSLIM™ Board GH” is a high-strength low thermal conductivity insulation material that is composed of siliceous material having a nano-pore structure incorporating thermal resistant reinforcement fiber and radiation scattering material. It has the following superior features.

- 1) Superior thermal insulation property which exceeds that of still air.
- 2) Good handling ability that surpasses conventional low heat conductivity insulation materials.

3) Superior workability that does not require special tools.

### 2.1 Structure and physical property

Table 1 shows the physical properties of “ROSLIM™ Board GH” and Figure 2 shows a comparison of the heat conductivity of various thermal insulation materials.

Table 1. Various physical properties of “ROSLIM™ Board GH”

Density [kg/m <sup>3</sup> ]	250	
Thermal conductivity [W/(m·K)]	at 400°C	0.030
	at 600°C	0.036
	at 800°C	0.044
Compressive strength [MPa] (10% compressive strain)	1.02	
Thermal shrinkage factor [%]	at 800°C × 24 hrs	0.6
	at 1000°C × 24 hrs	2.5
Maximum service temperature [°C]	1000	

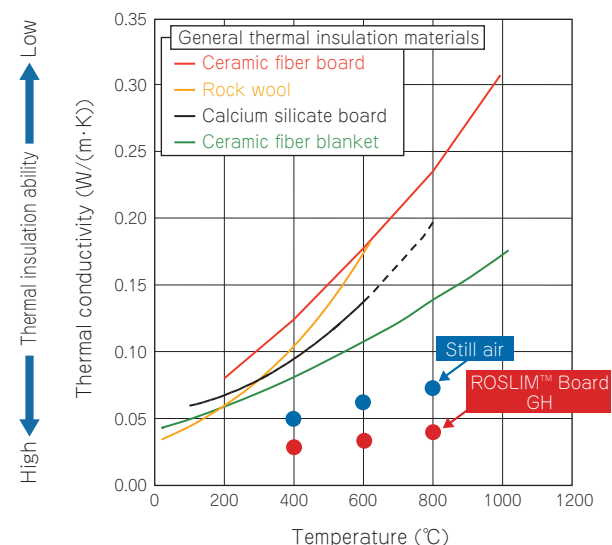


Figure 2. Comparison of thermal conductivity with those of various thermal insulation materials

“ROSLIM™ Board GH” shows superior thermal insulation properties with thermal conductivity less than 1/2 that of still air and 1/3 that of ceramic type fiber thermal insulation material (at 600°C). As shown in Figure 3, this is due to its structure having cavities of sufficiently

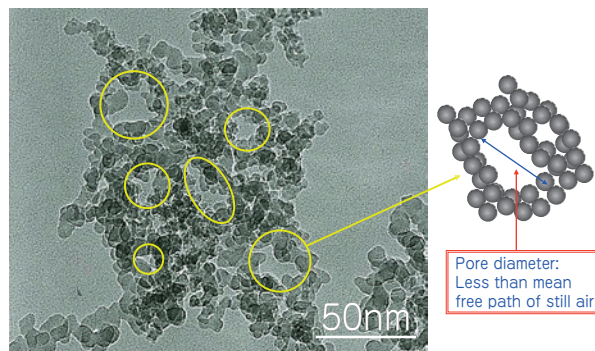


Figure 3. Inner structure of “ROSLIM™ Board GH” (TEM image) Mean free path of still air: 68 nm (normal temperature), 196 nm (600°C)

smaller size than the mean free path of still air, thus realizing the suppression of heat conduction via gas.

In addition, in the high temperature zone, the radiation scattering material scatters and attenuates radiation heat, realizing superior low thermal conductivity, half of that of still air.

### 2.2 Superior workability and handling ability

Figure 4 shows a machined product and an example of handling a large size plate of “ROSLIM™ Board GH”.

Because conventional low thermal conductivity insulation materials are brittle and easily collapsed,

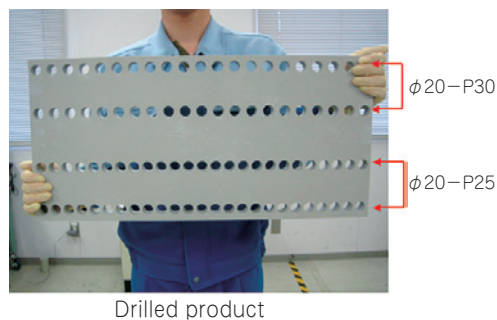


Figure 4. Handling of a drilled product and large size plate of “ROSLIM™ Board GH”

they are difficult to be machined or handled.

Owing to its special manufacturing method, the grain bonding strength is strengthened<sup>1)</sup> in “ROSLIM™ Board GH” and the overall strength of the material is high. Hence drilling with a hole saw can be easily done as shown in the figure. This high strength property contributes to its precision workability described later.

The wrought products or large size plates (25mm×600mm×900mm) can easily be handled where those made of conventional materials require the utmost care in handling.

### 3. Examples of actual applications

“ROSLIM™ Board GH” is used for thermal insulation of industrial furnaces (back-up material).

Here, a summary of the application examples of not only energy saving and downsizing, but also making use of its good workability are given.

#### 3.1 Energy saving utilizing thermal insulation property

Figure 5 shows an example of energy saving thermal insulation structure. When a “ROSLIM™ Board GH” of the same thickness as convention-

al thermal insulation materials (Such as calcium silicate board) is used for Industrial furnaces, owing to a decrease in heat radiation, the energy consumption is significantly decreased compared to those made of conventional materials.

As a specific example, Figure 5 shows that there is a 50% decrease compared to when the same thickness of calcium silicate board is installed in the same system.

#### 3.2 Down-sizing utilizing thermal insulation property

Figure 6 shows an example of a down-sized thermal insulation wall structure using “ROSLIM™ Board GH”.

Owing to its superior low thermal conductivity property, when the specified temperature on the outer wall surface is the same, “ROSLIM™ Board GH” realizes it with thinner thermal insulation material, which enables down-sizing of the furnace body and/or equipment. As a specific example, Figure 6 shows that for a furnace with an inner temperature of 1000°C, and a surface temperature of 57°C, a wall structure composed of “ROSLIM™ Board GH” will be 200 mm thinner than one composed of conventional materials.

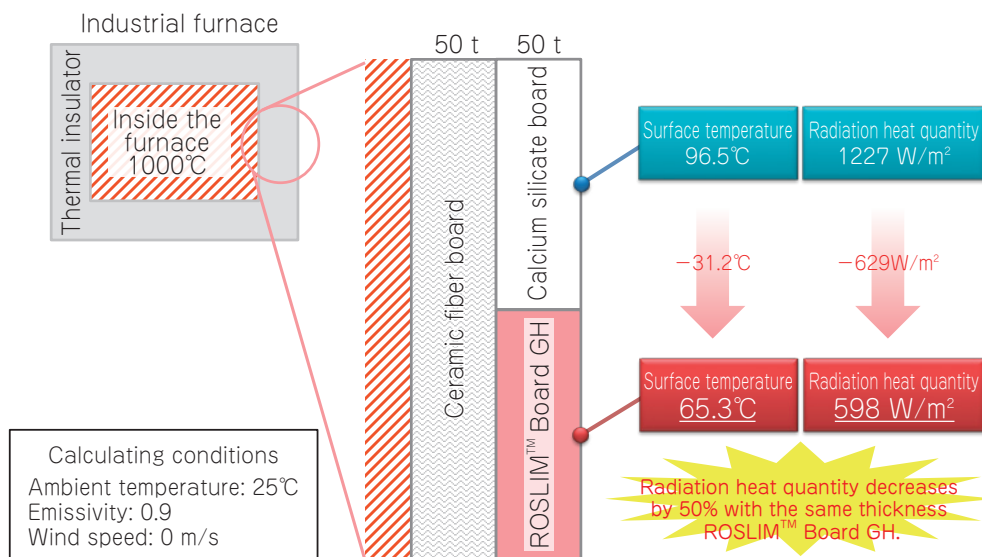


Figure 5. An example of energy saving structure for thermal insulation wall

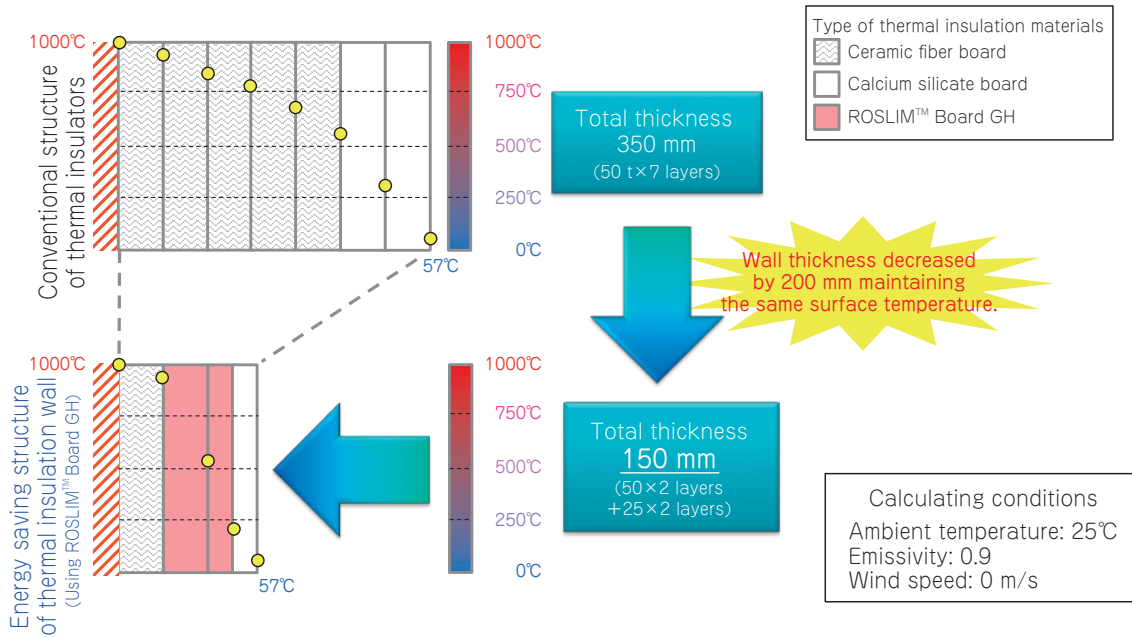


Figure 6. An example of down-sized thermal insulation wall structure

### 3.3 Application utilizing its high strength and good workability

Owing to the superior strength and workability of “ROSLIM™ Board GH”, work with large size boards is possible as it can be precisely machined to make complicated and/or irregular shaped products. Hence, there are a wide range of applications such as heat insulation (back up material) of special furnaces and thermal insulation material for fuel cells. The following are some examples of such applications.

- 1) Roller hearth kiln continuous furnace (back up material)

The thermal insulation materials for continuous heat treatment and continuous firing furnace require numerous drilling and processing of large diameter holes such as for exhaust openings. Because “ROSLIM™ Board GH” allows processing with machined large size boards for large-area side walls, ceilings and furnace floor, the heat leakage from joints is decreased, which further contributes to energy saving for the furnace body. In addition, it increases thermal uniformity within the furnace, and can increase the yield of processed products. The superior

handling property also contributes to shortening working time.

- 2) Heat retention of high temperature cylindrical molten metal container (back up material)

The superior workability allows not only flat surface application but also application on cylindrical shapes (Please contact us for the detail).

- 3) Thermal insulation parts that require high processing accuracy (such as thermal insulation material for fuel cells)

Figure 7 shows intricately processed “ROSLIM™ Board GH”. It can be processed to form complicated and/or irregular shapes such as thermal insulation parts for fuel cells which require space saving and high working accuracy.

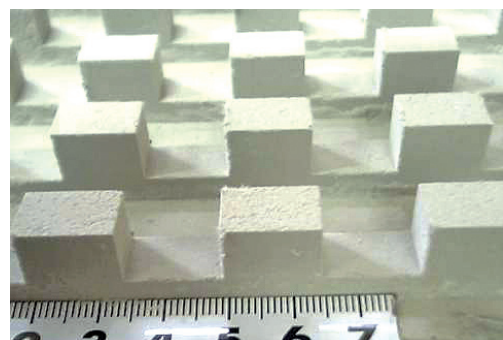


Figure 7. Example of complicated working

#### 4. Product dimension

The standard dimensions of “ROSLIM™ Board GH” are shown below.

- 25 t × 600 × 900 (mm)
- 50 t × 600 × 900 (mm)

For board sizes other than above or machined products, please contact us.

#### 5. Conclusion

TOMBO™ No.4350-GH “ROSLIM™ Board GH” is a breakthrough thermal insulator and just as the name implies, “Ro” (furnace) can be made slim and at the same time the energy consumption of the furnace slims down. There are many inquiries from manufacturers of industrial furnace and equipment, due to its low thermal conductivity added with superior workability.

We are putting effort into technical development and product development for higher performance thermal insulation material that meets further energy saving requirements of society, and will provide products to contribute to the society.

In addition, if there are any questions, please contact Energy Saving Products Technical Development Department, Industrial Product Division.

#### Bibliography

- 1) Inorganic thermal insulation material from the view of stress-strain, Nichias Technical Report, No.1, p15 (2016).

\* “TOMBO” is both a registered trade mark and a trade mark of NICHIAS Corporation.

\* “ROSLIM” is a trade mark of NICHIAS Corporation.

\* The measurements presented in this report should be used only as a guide and not as guaranteed values.