

Thermal insulation for fuel cells

Krosaki Harima Corporation's nano thermal insulation WDS[®] is a thermal insulation material based primarily on fumed silica that features best-in-class heat resistance and low thermal conductivity. This is extremely effective as an energy saving measure towards the achieving of carbon neutrality and has application to various products of which fuel cells is just the start. WDS[®] is able to thermally insulate high temperature locations including stacks and reformers, and satisfy requirements demanded of fuel cells including high thermal insulation, heat resistance and workability.

Benefits of nano thermal insulation relative to general thermal insulation

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|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Improved thermal insulation performance | Contributes to lower heat leakage at the same insulation thickness and reduced power consumption
Reduction of heating and heat retention energy, Heat retention of contents, Reduction of back side temperature |
| 2. Increased product internal volume | Able to reduce insulation thickness while maintaining thermal insulation performance and enable additional internal volume for the same external dimensions |
| 3. Space saving | Able to reduce external dimensions while maintaining thermal insulation performance |

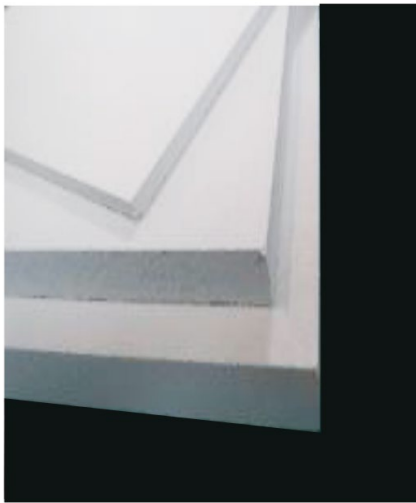
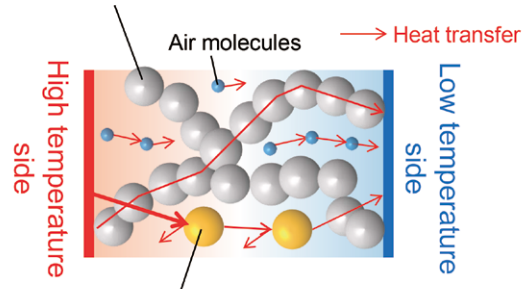


Fig. 1 WDS[®] appearance.

Fumed Silica (Major Components):

Formation of micropores using fine particles



Infrared shielding material: Limits transmission of radiant heat

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Inorganic fiber, other: Maintains form



**Achieves high heat resistance/
low thermal conductivity**

Fig. 2 Composition of nano thermal insulation.

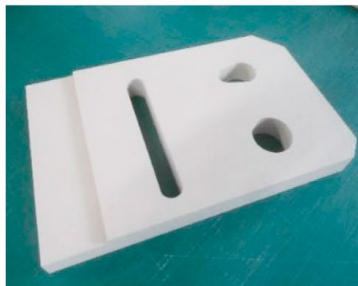


Fig. 3 Examples of machined thermal insulation.

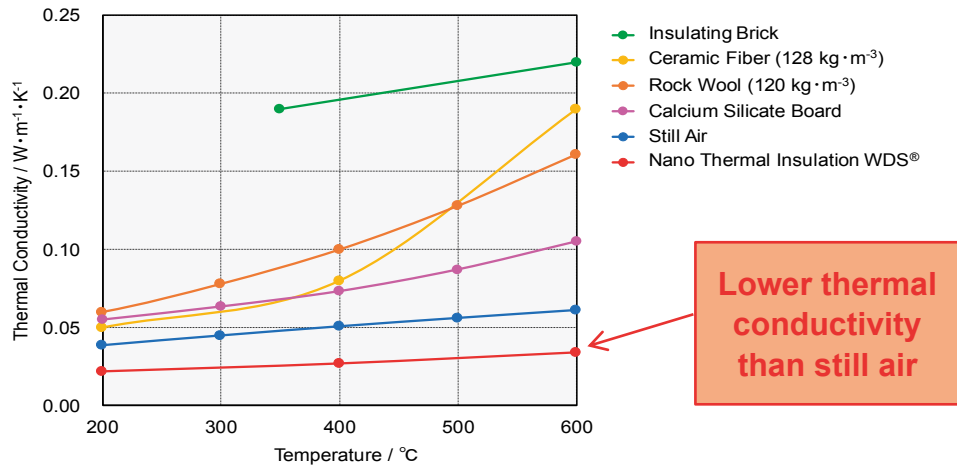


Fig. 4 Thermal conductivity characteristics of various insulations.

Table 1 Types of nano thermal insulation WDS®

Model		WDS® Ultra	WDS® LambdaFlex® Super
Board Size / mm		1000 × 650	1000 × 500
Thickness / mm		10, 15, 20, 25, 30, 40, 50	3, 5, 7, 10
Covering		None or Laminate Film, Woven Fabric, Metal Foil, etc.	
Max. Used Temp. / °C	Core	950	1050
Bulk Density / kg·m ⁻³		230	415
Compression Strength / MPa		>0.38	>0.94
Thermal Conductivity / W·m ⁻¹ ·K ⁻¹	200°C	0.022	0.032
	400°C	0.027	0.037
	600°C	0.034	0.045
	800°C	0.044	0.060
Workability (Complex Shape/Drilling)		Can be supported	
Handling	Cutting	Possible without specialized tools	
	Dust	Avoid dust leakage by covering	
Major Applications		Industrial Furnaces, Fuel Cells	Steel, Industrial Furnaces

* Values in the table are representative values and not guaranteed.

Nano thermal insulation WDS® has a wide range of applications beyond fuel cells. WDS® is well suited to high temperature applications where complex shapes are required such as steelmaking, industrial furnaces, automotive, rechargeable batteries and other equipment and products.

Krosaki Harima can assist with thermal calculations, thermal insulation design, selection of optimal materials and proposals for machining. We look forward to hearing your inquiries.

Table 2 Example applications of nano thermal insulation WDS®

Application	Part
Steelmaking Processes	Kilns for Blast Furnaces/Electric Furnaces
Aluminum	Ladles, Foundry Equipment
Fuel Cells	Thermal Insulation around Stacks and Reformers
Automotive	Thermal Insulation around Engines/Exhaust Pipes
Chemical Plant	Petroleum Refinery Facilities
Rechargeable Batteries	Thermal Insulation between Cells