AEROSPACE

AUTOMOTIVE

GENERAL INDUSTRIES

DOMESTIC APPLIANCES

INDUSTRIAL PIPES

FUEL CELLS

TECHNICAL INFORMATION

WDS®
High Temperature Insulation
WDS® – cool design solutions in the high-temperature range

At Porextherm, with its innovative WDS® heat insulation products, creating space – saving energy is always on the agenda.

Porextherm has successfully accepted the challenge in the area of high-temperature insulation and is today one of the market leaders and specialists for efficient heat insulation systems. As a driving force of innovation, we stand for the improvement of many products from different sectors of the industry, which depend on new, more efficient insulation systems and are engaged in the development of innovative products.

Particularly in the high-temperature range up to 1100 °C, structurally simple and convincing design solutions are sought after. Heat insulation designs with the smallest possible wall thickness considerably increase the useable volume and the energy requirement can be reduced drastically due to the superior heat retention capacity. This is where our extensive WDS® range of products comes in. We are not limited to a certain area of application, but we have developed a broad range of various application-specific products in order to meet the particular requirements of different sectors of the industry. In this respect, heat insulation in complex shaped products is playing an increasingly important role. In many cases, our specially shaped components are the ideal solution for even more efficient insulation in the most confined space and under the most difficult conditions.

We supply our know-how and our products in the area of high-temperature insulation to the following industrial branches:

– aerospace technology
– automotive industry
– general industry
– household appliances
– industrial pipes
– fuel cells
Microtechnology – the key to innovation for high-performance insulation materials from 500 °C to 1100 °C

The basic ingredient for the highly efficient insulation effect of our products is a microdispersed silica.

Between the spherical, microporous particles, only punctual transitions are able to form. This reduces thermal transfer by possible contact between solids to a large extent. In addition, the created micropores minimize heat transfer by convection. Specially developed infrared opacifiers, additionally reduce heat transport processes by absorption and reflection of radiation.

For example, based on the same insulating effect, layer thicknesses can be reduced with WDS® Ultra by factor 6 and the weight of the insulation can be reduced by factor 2 to 15.
Function principle and effect of microporous insulation materials in WDS® products

Due to their microporous structure, WDS® products offer extremely low heat transfer, which is even lower than that of still air.

WDS® is the ideal high-performance insulation material. It consists exclusively of inorganic oxides and contains no substances harmful to health.

Thermal conduction, convection and heat radiation are three types of heat transfer which are responsible for the thermal conductivity of a certain material. These three mechanisms are prevented in perfect fashion by WDS® products. This considerably reduces thermal conductivity. Therefore, WDS® offers extremely good thermal insulation characteristics.

1. Thermal conduction
Thermal conduction describes heat transfer in solids. Due to the molecule structure of the microporous material and the fact that the particles are spherical without exception, the contact points between the particles are infinitely small. The result of this is a very low thermal conduction between solids.

2. Convection
Whenever two gas molecules collide, there is an exchange of energy. This mechanism is responsible for the transport of heat by gases. The cell structure of the microporous material, with an average pore size of 20 nm, is smaller than the free length of path of the gas molecules. This is the main reason why the gas molecules collide with the walls of the pores, thereby reducing the exchange of energy between the individual molecules to an absolute minimum.

3. Heat radiation
Heat radiation takes place by electromagnetic waves and increases in significance with rising temperatures (> 400 °C). By the addition of infrared absorbing substances to the microporous material mix, this type of heat transfer is limited considerably.

Due to the minimization of heat transfer by conduction between solids, convection and heat radiation, the insulating effect of the microporous insulation material is superior to all other conventional insulating materials, such as mineral fibers, insulating firebricks or inorganic insulating panels.
Comparison of thermal conductivity of WDS®

The demand for optimized energy balances and the greatest possible useable volume governs the trend in the high-temperature range. For that reason, efficient thermal insulation with WDS® products will become a factor for success in the steel and aluminum industry as well as in the ceramic industry.

Regardless of density, WDS® shows, in comparison to other thermal insulation materials, the lowest thermal conduction values by far.

<table>
<thead>
<tr>
<th>Thermal Insulator</th>
<th>Thermal Conductivity (W/(m·K))</th>
<th>Density (kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDS®</td>
<td></td>
<td>250 - 350</td>
</tr>
<tr>
<td>Rockwool Boards</td>
<td></td>
<td>45 - 60</td>
</tr>
<tr>
<td>Boards of Calcium-Magnesium-Silicate Fiber</td>
<td></td>
<td>100 - 130</td>
</tr>
<tr>
<td>Boards of Calcium Silicate</td>
<td></td>
<td>260 - 300</td>
</tr>
<tr>
<td>Boards and flexible Panels of Glasswool</td>
<td></td>
<td>30 - 60</td>
</tr>
</tbody>
</table>
Comparison values of WDS® performance using the example of industrial projects

A widespread application of WDS® in the steel industry is the back-up insulation in steel ladles. The molten steel may reside for about 8 hours here, at temperatures up to 1700 °C. Newly developed refractory materials in combination with the flexible types of WDS® meet these requirements. On the one hand, thanks to the thinner layer thicknesses of WDS®, the usable volume can be improved by 10 % while maintaining temperature ratios and, on the other hand, the energy balance of the steel ladles can be optimized by nearly 50 % with a back-up insulation consisting of flexible types of WDS® with the same thickness.

In the aluminum industry, the smelting furnace as well as the launders are particularly critical process components in processing of primary as well as secondary aluminum. In order to keep the melting charge homogenously liquid in all areas of the furnace, an optimal temperature distribution must be achieved. With the use of WDS® Ultra as back-up insulation, this can be achieved in combination with an increase of the usable volume by an average of 15 %. The significant reduction of the cold side temperature by 20 °C on average results in a reduction of operating costs and an improvement in process reliability.

Another application in industrial high-temperature insulation is in the furnace construction for the ceramic industry. Newly developed insulation systems with WDS® Ultra enable engineers to design furnaces with reduced wall thicknesses while maintaining the same insulating effect. In this way, the usable volume can be increased by about 15 % without changing the exterior dimensions of the furnace. The significant reduction of the cold side temperature leads to an improvement in the energy balance per ton of fired finished products by an average of 25 % in comparison to conventionally insulated furnaces.
**Furnace construction, interior temperature 1,000 °C**

**BEFORE**
- **Layer 1:** Lightweight refractory brick  
  **Class 26 · Thickness:** 250 mm  
  **Temperature:** 387 °C
- **Layer 2:** Mineral wool 150 kg/m³  
  **Thickness:** 30 mm  
  **Temperature:** 67 °C

**Total layer thickness:** 280 mm  
**Heat loss:** 734 W/m²

**AFTER**
- **Layer 1:** WDS® Ultra  
  **Thickness:** 40 mm  
  **Temperature:** 65 °C

**Total layer thickness:** 40 mm  
**Heat loss:** 730 W/m²

**Ceramic kiln construction, interior temperature 1,250 °C**

**BEFORE**
- **Layer 1:** Lightweight refractory brick  
  **Class 26 · Thickness:** 115 mm  
  **Temperature:** 1,034 °C
- **Layer 2:** Lightweight refractory brick  
  **Class 23 · Thickness:** 115 mm  
  **Temperature:** 836 °C
- **Layer 3:** Fiber block 175 kg/m³  
  **Thickness:** 50 mm  
  **Temperature:** 666 °C
- **Layer 4:** Fiber block 150 kg/m³  
  **Thickness:** 50 mm  
  **Temperature:** 464 °C
- **Layer 5:** Fiber block 150 kg/m³  
  **Thickness:** 50 mm  
  **Temperature:** 62 °C

**Total layer thickness:** 380 mm  
**Heat loss:** 646 W/m²

**AFTER**
- **Layer 1:** Lightweight refractory brick  
  **Class 26 · Thickness:** 115 mm  
  **Temperature:** 1,040 °C
- **Layer 2:** Lightweight refractory brick  
  **Class 23 · Thickness:** 115 mm  
  **Temperature:** 684 °C
- **Layer 3:** WDS® Ultra  
  **Thickness:** 14 mm  
  **Temperature:** 474 °C
- **Layer 4:** Mineral wool 150 kg/m³  
  **Thickness:** 30 mm  
  **Temperature:** 61 °C

**Total layer thickness:** 274 mm  
**Heat loss:** 629 W/m²
WDS® – all advantages at a glance

- lowest temperature losses
- optimal temperature distribution
- increase of useable volume
- improvement of energy balance
- longer service life
- increased process reliability
- harmless with regard to health
- simple handling

The use of WDS® assures an even temperature profile. Thus, the service life of equipment is extended and process reliability is enhanced. WDS® products fabricated in accordance with your requirements offer the easiest handling imaginable.
High-performance insulation material by Porextherm – successfully in use in many branches

In the respective temperature ranges, our products are currently among the best insulation materials available on the market. They allow you to save extraordinary amounts of energy or to achieve outstanding insulation effects in very confined spaces.

In the area of modern consumer goods, we have already equipped many household appliances with cooking range top insulations. The radiation heating elements situated immediately below the cooking surface contain WDS® insulation materials, which have been chosen due to their outstanding mechanical and thermal characteristics. In storage heaters, Porextherm products facilitate the optimal utilization of the storage effect and in addition, contribute to the solution of space problems. Porextherm also offers innovative insulation systems for the automotive and aerospace industry, for example, for the thermal management of exhaust systems or fire protection insulation of aircraft engines. Another unique area of application is the insulation of offshore oil pipelines. Based on our own research and technology, Porextherm develops, jointly with our customers, innovative and unique insulation products. These may consist of individual problem solutions as well as systems that are suitable for integration in large serial productions.

This means that, in addition to our existing standard range of products, our customers are able to benefit from individual consulting services in order to contribute to the solution of their specific thermal insulation problems.
WDS® applications

Aerospace industry – engine insulation

Insulation of Ceran® ceramic stove tops

Storage heaters

Data carrier insulation

Automotive industry – temperature management in exhaust systems

Pipe-in-pipe – offshore pipeline insulation
The WDS® product range

**WDS® Ultra.** A proven product with particularly favorable thermal characteristics, used, among others, in the glass industry. WDS® Ultra is also available with edge and surface lamination in non-woven glass or aluminum foil.

**WDS® Ultra ESH.** Microporous panel for applications up to 900 °C, economically interesting, for example for off-peak storage heaters. WDS® Ultra ESH is available with edge and surface lamination in non-woven glass or aluminum foil.

**WDS® High.** An economically very competitive product, shrink-wrapped in polyethylene film. For application temperatures up to 1050 °C, which are preferred, for example, in furnace construction.

**WDS® High Glass Fabrics.** Variation of WDS® High. Sheathed in high-temperature resistant glass fabric. This allows to a large extent dust-free handling, in addition to significantly increasing the mechanical stability of the panel.

**WDS® Flexipor®** is a flexible, microporous insulation panel up to 1050 °C, shrink-wrapped in polyethylene film, with high insulating stability and low rate of heat transfer due to installation with reduced gaps.

**WDS® Lambdaflex®** is a flexible panel, vacuum-packed in polyethylene film to protect against moisture. For applications up to 1000 °C, for example, in the aluminum industry.

**WDS® Lambdaflex® Super** is also flexible, vacuum-packed in aluminum composite film and with high pressure stability. WDS® Lambdaflex® Super is used in the steel industry up to a temperature limit of 1100 °C.

**WDS® Flexible Contour** is a thin, microporous insulation mat with an extremely low coefficient of thermal conductivity. Three-dimensional shapes can be created due to the easy deformability of the panel. The product is used in the area of manifolds, catalysts and DPF in automobiles.

**WDS® Flexible Design** is a microporous thermal insulation material with an extremely low coefficient of thermal conductivity. It was specially developed for applications in exhaust systems of automobiles and commercial vehicles. The geometry of the panels can be individually adapted to the requirements of the customer.

**WDS® Flexible Design-AL** was developed especially for applications in exhaust systems of automobiles and commercial vehicles. The geometry of the panels can be individually adapted to the requirements of the customer: For flexibility reasons, WDS® Flexible Design AL comes wrapped in aluminum foil. This foil provides very high stability and sturdiness in use.

**WDS® Pad** is a microporous thermal insulation material for the production of shaped insulating components in Ceran® stove tops in the household appliance industry.

**WDS® Shape** is a panel with particularly high mechanical strength and density. Ideal for further processing by milling or cutting.

**WDS® Flexible Pipe** is a microporous insulation material that was specially developed for use in double-walled off-shore pipelines (pipe-in-pipe). Due to the special slot patterns, the panels can be wrapped around the pipes without any problem.

**WDS® Protection G** is a hydrophilic inorganic coating that can be used on all WDS® products. WDS® protection G is non-combustible and suitable for applications with temperatures up to 900 °C.

For further detailed information, please visit our website at www.porextherm.com or call us for expert consultations.