

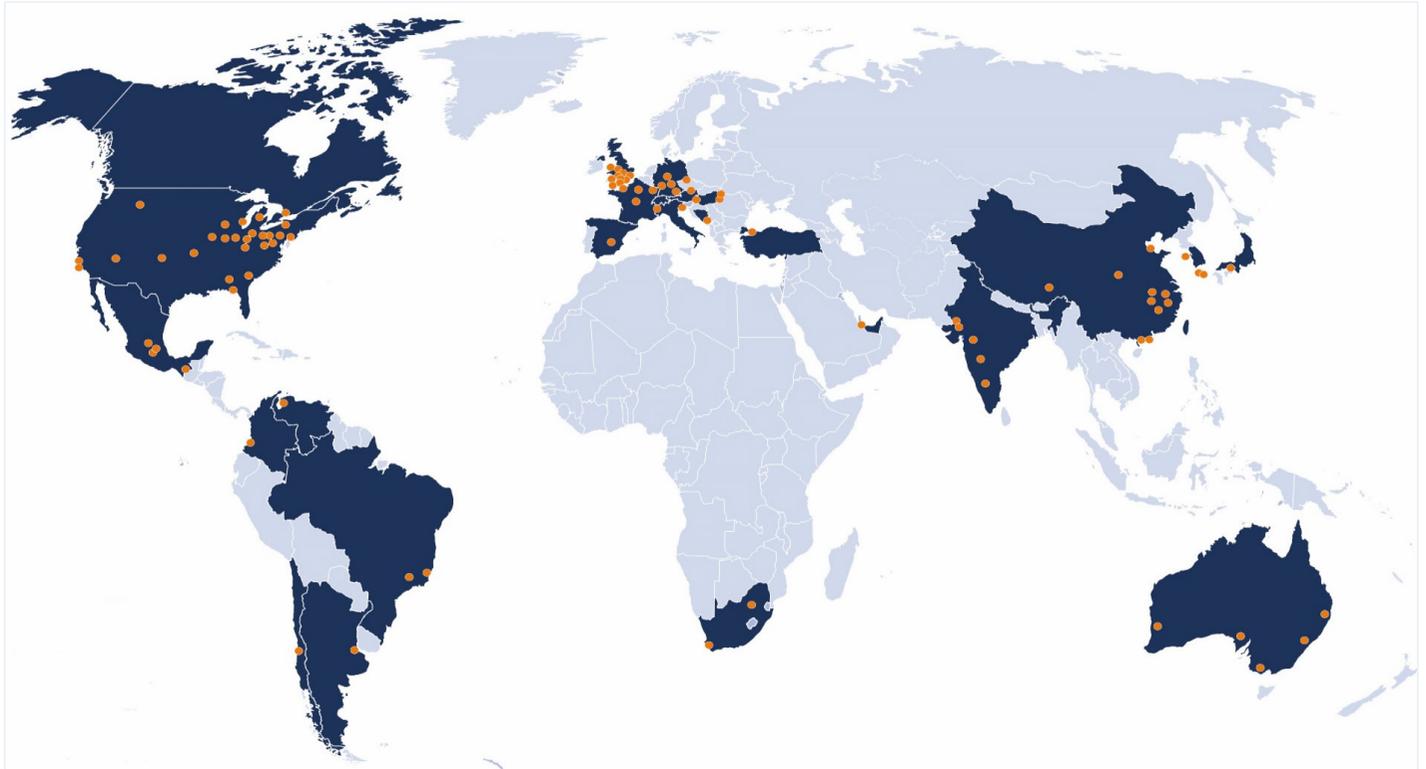
Fibre, Refractory & Microporous
Thermal Management Solutions
from Thermal Ceramics



Morgan Advanced Materials

Advanced materials enabling sustainability and safety of people and processes

Morgan Advanced Materials is a global manufacturer of specialized engineered products made from carbon, advanced ceramics and composites. Our purpose is to use advanced materials to help make more efficient use of the world's resources and to improve the quality of life.



- A global engineering company headquartered in Windsor, UK, and listed on the London Stock Exchange (FTSE 250)
- Established for over 160 years
- Our footprint
 - Selling into 100 countries
 - Manufacturing in 30 countries
 - Approximately 7,500 employees



Our purpose guides our actions; it underpins our work to **reduce our environmental impact**, informs **how we treat our people**, and ensures we fulfil our responsibility for **good corporate governance**.



We play an important role in society, using our deep materials science knowledge and process capability to solve customer problems and deliver on our purpose.



Thermal Ceramics

We innovate to meet the challenges of a changing world

The Thermal Ceramics business of Morgan Advanced Materials makes advanced ceramic products and systems for thermal insulation in high-temperature environments. We engineer products and systems for equipment in demanding applications and for the safety of people and processes.

Our portfolio and engineering capabilities help customers, especially those operating energy-intensive processes, to reduce energy consumption, emissions, and operating costs.

Thermal Ceramics has sales and operations in more than 30 countries and employs around 3,000 people. Our extensive network of sales and distribution partners allows Thermal Ceramics to serve the global market with well supported regional personnel.



Wherever you are in the world, our geographical coverage and engineering expertise ensures that you are provided with the highest levels of service and support, throughout the development and purchasing of your insulation solutions.

Creating advanced thermal solutions
for a **safe and sustainable world**

Thermal Ceramics

Markets we serve



Building & Construction

Fire Resistant
Ducts, Structural
Steel, Tunnels



Automotive

EV, Heat Shields,
Friction, Filtration



Battery Safety & Energy Storage



Petrochemical

Ethylene, Heaters,
Reformers, FCCU



Fuel Cells & Hydrogen

MCFC, SOFC,
H2 Reformers



Marine

Shipbuilding,
Offshore
Platforms



Iron & Steel

Molten Metal,
Transfer, Furnaces,
Crucibles



Temperature Controlled Packaging



Power Gen

HRSG, Boilers,
Renewables



Aerospace

Nacelles, Thrust
Reverser, Ducting,
Battery, Critical
Data Recorders



Ceramics

Industrial Kilns,
Hobby Kilns,
Kiln Furniture



Consumer Goods

Cooking Applications,
Fireplaces, Water
Heaters



Glass

Glass Melting
Furnaces



Cement

Precalciner,
Preheater Kilns



Railways

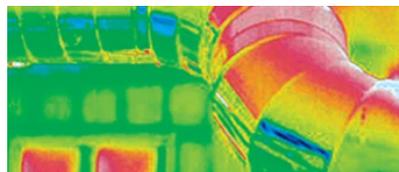
Tank Car, Battery,
Critical Data
Recorders

Capabilities



Engineering Design and Collaboration

Integrated thermal
management for effective
process solutions



Thermal Management Assessment and Simulation

Infrared thermography inspection
to validate assumptions and
performance after installation



Installation Supervision and Services

Infrared thermography inspection
to validate assumptions and
performance after installation

Thermal Ceramics

We innovate to meet the challenges of a changing world



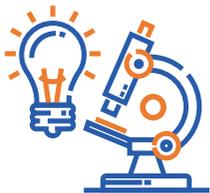
Safe and Reliable Products

Our products and systems protect lives and processes 24 hours a day and 365 days of each year.



A Truly Global Footprint

We have operations on 5 Continents and in 30 Countries to efficiently serve our Customers.



Commitment to Innovation

For you, for us, for our people and our planet our commitment to innovation is paramount in all we do.



Trusted Engineering Services

Our global resources and dynamic engineering services efficiently support our Customers application demands.

Product materials

Material types	Product forms
Fibres	
<ul style="list-style-type: none"> Low Biopersistent Fibres (LBP): Superwool® 	Bulk fibres, Blankets, Modules, Log, Boards, Shapes, Papers, Felts, Mastics, Textiles
<ul style="list-style-type: none"> Refractory Ceramics Fibres (RCF): Kaowool®, Cera® 	
<ul style="list-style-type: none"> Polycrystalline Wool Fibres (PCW): Denka®, Maftec® 	
Fired and Shaped Refractories	
<ul style="list-style-type: none"> High Alumina Firebricks: SR™ 	Bricks and Shapes
<ul style="list-style-type: none"> Insulating Firebricks (IFB): JM®, K™, TJM® 	
<ul style="list-style-type: none"> Monolithics: Insulating - Kaolite®, Firelite®, Dense - Kaocrete®, Firecrete®, Morflo® Special Duty - Kao-Tuff™, Kao-Tab™, Plascast™, Plasgun™ 	Cast, Gun, Ram, Vibratory
<ul style="list-style-type: none"> Crucibles and Fired Shapes: Cerox®, Valcor® 	Varies by chemistry
Microporous	
<ul style="list-style-type: none"> WDS®, Min-K®, Vacupor® 	Boards, Panels, Flexible
FireMaster Passive Fire Protection	
<ul style="list-style-type: none"> FireMaster 	Blankets, Duct Wraps, Boards, Papers, Felts, Bulk Fibres, Flexible Panels, Monolithics

Thermal Ceramics designs, manufactures and installs a broad range of thermal insulation products that reduce energy consumption and emissions in a variety of high temperature processing applications.

In use, high temperature insulation will:

- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency and lifecycle performance of furnaces and process equipment

Our product offering is extensive and is organized into the following categories, with available product forms, typical of the high temperature insulation industry:

- Fibres
- Fired and Shaped Refractories
- Microporous

Fibres

Our fibre portfolio consists of chemistries to address the most demanding and harsh environments. Our fibre portfolio covers applications requiring a classification temperature up to 1600°C (2912°F).

Shared benefits of our fibre portfolio and chemistries are:

- Excellent thermal stability and insulation properties
- Low thermal mass
- Low thermal conductivity
- Flexible, resilient and immune to thermal shock
- Good resistance to tearing
- Low heat storage capacity
- Good acoustic properties

Low Biopersistent fibres (LBP): Superwool Plus, Superwool Prime and Superwool XTRA

Low Biopersistent Superwool fibre has been developed to show improved high temperature characteristics required to act as an alternative to RCF in applications where possible. The Superwool fibre family of products offer a versatile alternative to traditional insulation solutions for commercial, industrial, and transportation applications. Superwool fibre patented chemistries and manufacturing technologies are available as Alkaline Earth Silicate (AES) fibres - Superwool Plus, 1200°C (2192°F) and Superwool Prime, 1300°C (2372°C) and our newest innovation that does not form respirable crystalline silica, Potassium Alumino Silicate (PAS) - Superwool XTRA, 1450°C (2642°F).

Additionally, Superwool fibres are exonerated from carcinogen classification within Europe, are not classified as hazardous by IARC or under any national regulations on a global basis and do not require warning labels under Globally Harmonized System for the classification and labeling of chemicals (GHS).



Refractory Ceramic Fibre (RCF): Kaowool®, Cera®

RCF fibres are a highly versatile material which are manufactured via blown or spun technology. Our RCF portfolio are available in Kaowool and Cera chemistry compositions globally and are traditional insulation solutions for commercial, industrial, and transportation applications.

Polycrystalline Wool Fibres (PCW)

Polycrystalline fibre is produced by sol-gel technology from aqueous spinning solutions and is suitable for use at application temperatures > 1300°C (2372°F) and in critical chemical and physical application conditions. In addition to the shared benefits and features of all fibre products, our Denka and Maftec portfolios also provide outstanding chemical stability, minimal linear shrinkage and < 1% shot content compared to RCF and LBP portfolios.

Fired and Shaped Refractory

Thermal Ceramics high-temperature insulation refractories from 650°C to 1870°C (1200°F to 3400°F) include:

- High Alumina Firebrick and IFB: SR™, K™, JM®, TJM®
- Monolithics: Kaolite®, Firelite®, Kaocrete®, Firecrete®, Kao-Tuff™
- Crucibles and Shapes: Cerox®, Valcor®

High Alumina Firebricks from Thermal Ceramics are available for temperature use up to 1788°C (3250°F) and marketed as SR-90 and SR-99.

Insulating Firebricks (IFB) are manufactured with very low thermal conductivity and high hot load strengths. JM, K and TJM branded bricks have the ability to withstand chemical attack and high heat conditions. Both wet and dry mortars are available that are matched for use with our IFB range.

Fired Refractory Crucibles and Shapes are individually crafted as Cerox and Valcor. Crucibles and fired shapes hold up under harsh conditions. With various alumina-silica, silicon carbide, high-alumina and alumina-silica-zirconia compositions, these materials offer excellent hot strengths and resistance to thermal shock and molten metals.

Monolithics are available in Insulating, Dense and Special Duty Monolithics. World-recognised branding, our Dense Monolithics are proven reliable and trusted for applications that require strong, easy to place and economical materials. The Insulating portfolio is trusted to provide low thermal conductivity values, ease of installation and superior performance, especially in petrochemical applications. Special Duty Monolithics such as Kao-Tuff®, Plascast / Plasgun®, and Kao-Tab® feature specifically enhanced properties such as resistance to corrosion, abrasion and reducing atmospheres

Microporous

Our portfolio of high temperature microporous performs where classification temperatures range from 900°C to 1100°C (1650°F to 2012°F). This portfolio is organized into specific industries and markets based on specification requirements by application:

- Aerospace, Advanced Technology, Critical Data Recorders: Min-K®
- Industrial, Transportation, Commercial: WDS®

Microporous insulation is designed for technologically advanced applications in aerospace to industrial markets. Specially formulated and designed for applications such as ladle liner back-up insulation for Iron and Steel and board back-up insulation in Ethylene crackers. These lightweight, high compressive strength materials are the most thermally efficient insulation available.

In addition to our high temperature microporous portfolio, we also offer a full line of low temperature Vacuum Insulation Panels designed and formulated for applications in construction, temperature controlled packaging and transportation.





Bulk fibres

Thermal Ceramics bulk fibres serve as the foundation for our entire line of fibre products. Bulk fibres consists of a loose mass of randomly orientated normally long, fibres collected after fibrisation and not further altered and can be:

- Needled into a blanket
- Converted into paper boards and shapes
- Woven into yarn to produce rope and cloth
- Blended into liquid binders for coatings and cements

Bulk fibres can be engineered by changing length, fibre diameter, shot content and lubricity. They offer unique solutions to many industrial applications such as expansion joint construction and base seals as well as automotive applications in filtration and acoustical insulation. High temperature insulation wool is a material for use in high temperature applications such as the insulating lining of metallurgical ovens and furnaces, petrochemical heaters, and ceramic kilns etc.

In use high temperature insulation fibre will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Grades available:

- Lubricated bulk fibres are available as extra long and lubricated fibres
- Unlubricated bulk fibres are available in a variation of fibre lengths - short, medium, long, and extra long



Physical characteristics

- Classification temperature up to 1600°C (2912°F)
- Excellent insulating performance
- Low heat storage
- Fibre diameter and length control variables

Applications

- Thermal and acoustical insulation
- Raw material in fibre-based products like mastics, boards, shapes, and textiles
- Friction fibres for braking systems
- Expansion joints
- Reinforcing material for insulating monolithics and cements
- Chimney fill
- Insulating fill for voids, complex shapes and other difficult to access areas

Brands

- Kaowool®
- Cerafibre®
- Cerachem®
- Cerawool®
- Superwool® Plus
- Superwool Prime
- Alphawool™
- Denka®
- Maftec®

Blankets

Thermal Ceramics blankets are available in a wide range of chemistries, densities and dimensions.

Blankets are manufactured via blown and spun technologies. Our Thermal Ceramics blankets are air laid into a continuous mat and mechanically needled for added strength and surface integrity. A needling process results in a forced matrix of bulk fibres to produce a coherent blanket without the use of chemical binders.

High temperature insulation wool is a material for use in high temperature applications such as the insulating lining of metallurgical ovens and furnaces, petrochemical heaters, and ceramic kilns, etc.

In use, high temperature insulation fibre will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Common characteristics are:

- Low thermal conductivity
- Excellent thermal shock resistance
- Low heat storage capacity
- Inorganic - smoke free

Physical characteristics

- Classification temperature up to 1600°C (2912°F)
- Excellent insulating performance
- Excellent thermal shock resistance
- Low heat storage capacity

Applications

- Furnace, boiler and kiln insulation linings
- Thermal barriers
- Fire Protection
- Field stress relieving
- Steam and gas turbine insulation

Brands

- Kaowool®
- Cerafibre®
- Cerachem®
- Cerablanket®
- Cerawool®
- Superwool® Plus
- Superwool Prime
- Superwool XTRA
- FireMaster®
- Alphawool™
- Denka®
- Maftec®





Modules and Logs

Pyro-Bloc® Modules and Pyro-Fold™ and Pyro-Stack™ Blanket Modules are the leading lining solution for industrial furnaces, heaters and kilns. Improving energy use, reducing emissions and optimising your thermal processes for safety of your equipment and people.

Trusted and reliable performance, our Pyro-Bloc and Blanket Module Systems have been chosen and specified for decades.

Our comprehensive portfolio developed for high-performance applications with classification temperatures up to 1450°C (2642°F).

- Exceptional insulating performance with **20% energy savings** with our Superwool fibres
- Excellent thermal stability results in **reliable and consistent thermal insulating performances**
 - » Immune to thermal shock
 - » Thermal stability
 - » Low heat storage
- High **erosion resistance no damage up to 50 m/sec** tested:
 - » RCF fibre modules 1260°C (2300°F) and 1430°C (2600°F)
 - » Superwool Plus and Superwool Prime fibre modules 1200°C (2192°F) and 1300°C (2372°F)
- Excellent resistance to chemicals and pollutants, especially alkali metals
- Excellent tensile strength
- Good sound absorption

Physical characteristics

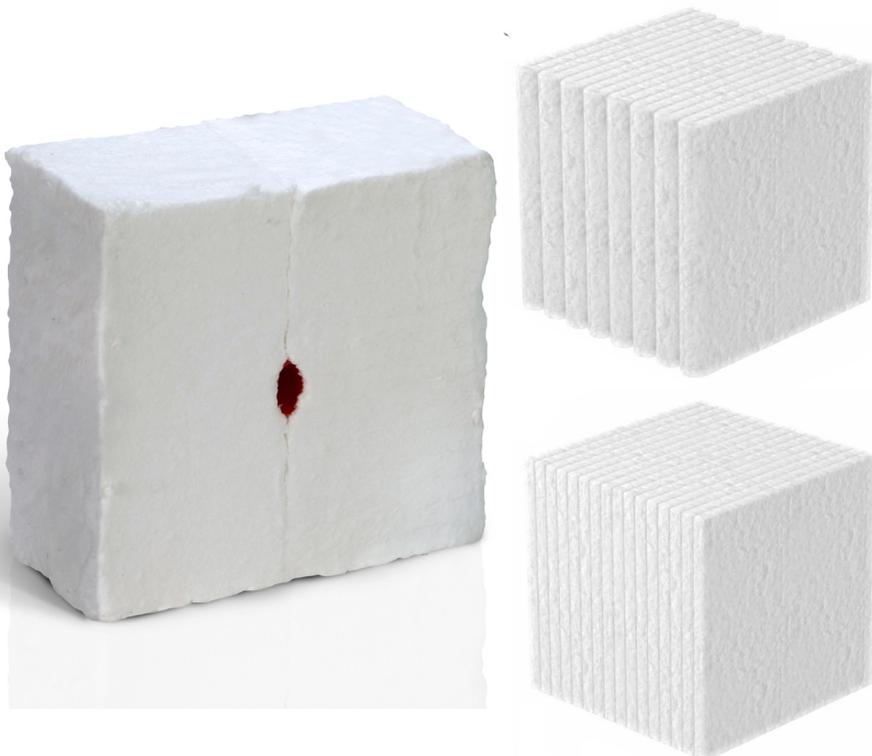
- Classification temperature up to 1430°C (2600°F)
- Exceptional insulating performance
- Excellent thermal shock resistance
- Low heat storage capacity
- Monolithic ceramic fibre composition

Applications

- Furnace, boiler and kiln insulation linings
- Burner blocks
- Furnace and boiler doors
- Harsh and corrosive environments
- High air velocity environments

Brands

- Pyro-Bloc Modules
- Pyro-Fold Blanket Modules
- Pyro-Stack Blanket Modules
- Pyro-Log™



Papers

Thermal Ceramics manufactures a wide range of high temperature rated paper products. We meet requirements ranging from economical mineral wool grades to high purity alumina and alumina-silica grades for demanding applications.

Paper products are specially manufactured to offer excellent performance in high temperature applications and offer an alternative to traditional solutions due to its unique properties of high refractoriness and excellent non-wetting characteristics to applications requiring direct contact with molten aluminum and stability and resistance to chemical attack.

Insulating paper conforms easily to complex shapes and can be die-cut and used in a wide range of applications as thermal insulation and are especially suited to use in gaskets and as a parting medium.

Many of our paper products also meet strict automotive, aerospace, and industry specifications.

In use, high temperature insulation fibre will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment



Physical characteristics

- Classification temperature up to 1650°C (3000°F)
- Excellent tensile strength
- Low thermal conductivity
- Thickness availability of 0.8 up to 38 mm (1/32 up to 1in)

Applications

- High temperature gaskets and seals
- Refractory back-up insulation
- Filtration
- Separating media

Brands

- Kaowool®
- K-Shield™
- Superwool® Plus
- Superwool Prime
- Superwool XTRA
- EST™ Papers specially developed for battery systems and energy storage applications



Felts

Our Thermal Ceramics line of insulating felt products, obtained by hot pressing are particularly suitable for die-cutting operations. Semi-rigid, it is neither brittle nor dusty. Felt optimizes the manufacture of complex, die-cut shapes to close tolerances.

- Superwool Felts
 - » Superwool Felts are made from Superwool fibres, bonded with an organic binder which begins to burn out at 180°C (356°F). This special binder makes Superwool felt particularly suitable for die-cutting operations. Made from chemically stable fibres, lightweight and very insulating, Superwool felt is a multi-purpose product.
- Cerafelts
 - » Cerafelts are made in a unique manufacturing process which allows a wide thickness and density range. Recommended for high temperature industrial applications such as expansion joints in kilns, furnaces, and boiler walls. When used as a gasket, Cerafelt exhibits excellent resistance to penetration from molten metal both ferrous and non-ferrous. This unique property coupled with its ease of fabrication makes it ideal for ingot stool seals and stopper rod gaskets.
- K-Shield Felts
 - » The K-Shield felt range of products are manufactured on the same line as the high temperature paper products. This manufacturing process allows excellent, uniform material density and thickness control. In addition, the lightweight, flexible nature of this product allows it to be packaged in roll form. K-Shield felts are made from very clean, high purity ceramic fibres.

Physical characteristics

- Classification temperature up to 1430°C (2600°F)
- Flexible, lightweight
- Low thermal conductivity
- Thickness availability from 3 to 25 mm (1/32 to 1/2 in)

Applications

- High temperature gaskets and seals
- Expansion joints
- Molten metal resistant insulation

Brands

- Cerafelt®
- K-Shield™
- Superwool® Plus
- Superwool Prime



Boards and Shapes

Thermal Ceramics wide range of products are manufactured using state of the art vacuum forming technology. This versatile process, flexible in batch size, allows the production of products in different geometries according to your bespoke specifications and dimensions for your application.

Our Boards and Shapes cover an entire temperature and mechanical strength range. They feature excellent insulating performance, and superior high temperature strength.

Manufactured from our bulk fibres, these products are available in grades:

- Low Biopersistent Fibres (LBP) - Superwool®
- Refractory Ceramic Fibres (RCF) - Kaowool®
- Polycrystalline Wool Fibres (PCW) - Denka® and Maftec®

Organic and inorganic compositions are available and offer:

- Low thermal conductivity and low heat storage
- Excellent thermal shock resistance
- Dimensional stability up to 1600°C (2912°F)
- No off-gassing during initial heat up of inorganic products

Boards and Shapes

- Wide range of standard thicknesses and sizes (boards)
- Tight tolerances can be achieved post-production (boards)
- Custom shape designs for optimized high temperature performance, utilising decades of application experience (shapes)
- Single-use and integral parts capability (shapes)
- Superior insulating performance, excellent molten metal resistance, and high strength
- Expertise in embedding hardware for integrated mounting, support or process specific benefits (shapes)
- After-treatment application of Alfibond® and Minimox™ for many RCF grades



Physical characteristics

- Dimensional stability up to 1650°C (3000°F)
- Excellent thermal shock resistance
- Low heat storage
- Low thermal conductivity
- Range of mechanical strengths

Applications

- Furnace and kiln hot face linings
- Combustion chambers for boilers and heaters
- Appliance and heat processing insulation
- Hot tops, riser sleeves
- Burner blocks

Brands

- Kaowool
- Inorganic I-series
- Superwool Plus
- Superwool Prime

Mastics: Pumpables, Mouldables, Coatings and Cements

Thermal Ceramics full product offering of fibre based insulation materials available as pumpables, moldables, coatings and cements.

Manufactured specifically to aid in efficient furnace, kiln and boiler operation, these products eliminate hot spots, provide superior maintenance solutions, and make insulation installation quick and easy.

Our Pumpables, Mouldables, Coatings and Cements are unique to each manufacturing region. Each utilizing our global fibre chemistry grades, RCF, Kaowool® and Cera® and LBP, Superwool® and local raw materials to create the Mastic portfolio required to support regional industry and application demands.

For use in high temperature industrial applications where patching and filling of voids is required, available as pumpables (with pumps), moldables, air-setting cements and coatings.



Pumpables

- Classification temperature use up to 1540°C (2800°F)
- Non-wetting to molten aluminium

Applications

- Furnace, boiler and kiln hot spot repair - online or during shut-down
- Back-up insulation

Mouldables

- Classification temperature use up to 1430°C (2600°F)

Applications

- Through linings and hot face linings
- Back-up insulation
- Patching mix for fibre products or linings

Coatings

- Classification temperature use up to 1650°C (3000°F)
- Good abrasion resistance

Applications

- Grout refractory joints and gaps
- Seals furnace lining cracks
- Furnace maintenance and emergency repairs

Cements

- Classification temperature use up to 1316°C (2400°F)
- Develops strong bond upon drying
- Increases surface hardness and resistance to erosion

Applications

- Surface treatment for fibre boards and shapes to increase surface hardness
- Adhesive to bond materials together

Brands

- Kaowool
- Cera
- Superwool
- Sealcoats™
- Therm-O™
- Unikote™

Insulating Firebricks

Market leading brands JM[®], K[™], and TJM[®] Insulating Firebrick (IFBs), bring unsurpassed performance in a wide variety of markets and offer:

- Geographical manufacturing base
- Extensive range of manufacturing techniques
- Complete range of IFB temperature and mechanical properties
- Network of global distribution
- Experienced team dedicated to IFB technical support in the industry

Insulating Firebricks, features include:

- Excellent strength at ambient and elevated temperatures
- High compressive strength
- Every brick ground to precise dimensions
- Very low levels of iron and other impurities (especially for resistance to reducing atmosphere conditions)
- Lower heat storage than denser refractories
- Available in custom designed shapes upon request

Insulating Firebricks, benefits include:

- Energy-saving benefits
- Lower operating costs
- Lightweight, energy-saving nature results in less heat loss and allows for opportunity of thinner furnace linings

Insulating Firebricks (IFBs) are well established products for solving many problems of high temperature heat containment in industries ranging from ceramic production kilns to anodes for primary aluminium.



Physical characteristics

- High temperature use limit up to 1650°C (3000°F)
- Bubble Alumina IFB up to 1800°C (3300°F)
- Extremely low thermal conductivity
- Low densities and heat storage
- Excellent resistance to alkali attack
- High purity
- Good strengths
- Low shrinkage

Applications

- Aluminium anode bake furnaces, primary electrolytic cells, holding and melting furnaces and secondary remelt furnaces
- Petrochemical furnaces, flues, refining vessels and reactor chambers
- Iron and steel industry, hot blast furnace stoves, hot blast main and bustle pipe, heat treatment and galvanizing furnaces
- Metals, heat treatment and atmosphere furnaces
- Ceramic industry, including kilns for domestic and laboratory use
- Glass industry
- Hot Face and Backup insulation in industrial furnaces

Brands

- JM IFB range manufactured in our EMEA region

Mortars

Thermal Ceramics offers a comprehensive range of Mortars that are both global and regional specified to complement our range of High Alumina Firebrick and Insulating Firebrick portfolio.

These Mortars are available as dry or wet formulations depending on application requirements. Our comprehensive line provides a wide range of innovative solutions for heat-intensive challenges.



Physical characteristics

- High temperature use limit up to 1800°C (3300°F)
- Complement the High Alumina Firebrick and Insulating Firebrick portfolio used in application

Applications

- Aligned to application and brick selection

Brands

- Blakite®
- JM®
- High-Temp™
- K-Bond™
- Smoothset™
- Airset™
- Coastal™

Monolithics

Thermal Ceramics produce a range of Monolithic materials which can be placed in-situ by casting, gunning, vibration, free flowing, trowelling or ramming. Our comprehensive line provides a wide range of innovative solutions for heat-intensive challenges.

Available in different formulations, densities, and having different installation methods, monolithics can be used as primary or secondary insulation, for repair, or for speciality applications. Particular grades will be selected depending on the structure to be lined.

A lining may be installed using a single material or can be a complex selection depending on the environment and operation of the lined structure.

Specific grades have been developed for high temperature insulation, metal contact, slag resistance, abrasion resistance or thermal shock resistance.



Insulating Monolithics

- Used for the containment of heat within high temperature operating structure and can be used for either hot face working linings or as backing linings behind higher density working linings.

Brands

- Kaolite® and Firelite®

Dense Monolithics

- Dense and Conventional grades are bonded by high alumina cements
- Easily placed by casting or gunning
- Offer good performance in most general applications
- Low cement grades are formulated typical 5-7% and have incorporated fine fillers and dispersants which significantly reduce water demand and enhance physical properties
- Low cement grades contain cement additions of 10-15% and offer easy mixing and installation
- They offer excellent resistance to abrasion and thermal shock for general purpose application

Brands

- Kaocrete® and Firecrete®
- Tri-Mor®
- Hicast®
- Morflo®
- Higon™
- Plascast™ and Plasgun™
- Vibrotek™

Special Duty Monolithics

- Aluminium resistance developed with enhanced resistance to corundum growth when in contact with molten aluminium
- Special duty abrasion resistant grades
- Compositions bonded with phosphate binders offer excellent resistant to most molten metals and slags

Brands

- Albond® and Alcast®
- Kao-Tab™ and Kao-Tuff™

Microporous

Our Microporous high temperature insulation products feature a classification temperature rating up to 1100°C (2000°F). Microtechnology is the key to the innovative WDS Technology. This unique manufacturing technology creates micropores that minimise heat transfer by convection. Specially developed infrared opacifiers, reduce heat transport processes by absorption and reflection of radiation.

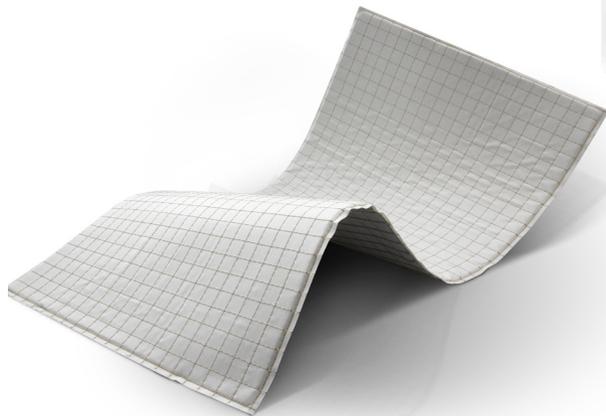
For more than 50 years, Thermal Ceramics has provided Min-K® Microporous thermal insulation to the aerospace industry.

These critical aerospace applications require material solutions for vibration resistance, extremely low thermal conductivity and space saving, lightweight products.

Our industrial and transportation industry solutions are marketed as WDS® Microporous that offer similar features.

Min-K Microporous is the industry leading standard for aerospace applications. From thrust reverser insulation to Auxillary power units to critical data recorders, the lightweight, vibration resistant materials meet the challenges of these critical, demanding applications.

WDS Microporous products are specially formulated and designed for applications such as ladle liner back-up insulation for Iron and Steel, board back-up insulation in Ethylene crackers and flexible pipe solutions for many industrial processes.



Physical characteristics

- Perfect and consistent mineral matrix distribution
- Optimised porosity of the interconnecting chain
- Superior mechanical properties
- Quantity and distribution of opacifiers
- Microscopic particles sizes

Applications

- Heat treatment systems for metals and glass
- Fire protection equipment
- Power plants
- Chemical plants
- Pipe Insulation
- Parts in the Automotive Industry
- Chimneys, pipes and diesel exhaust systems
- Deepwater oil production

Brands

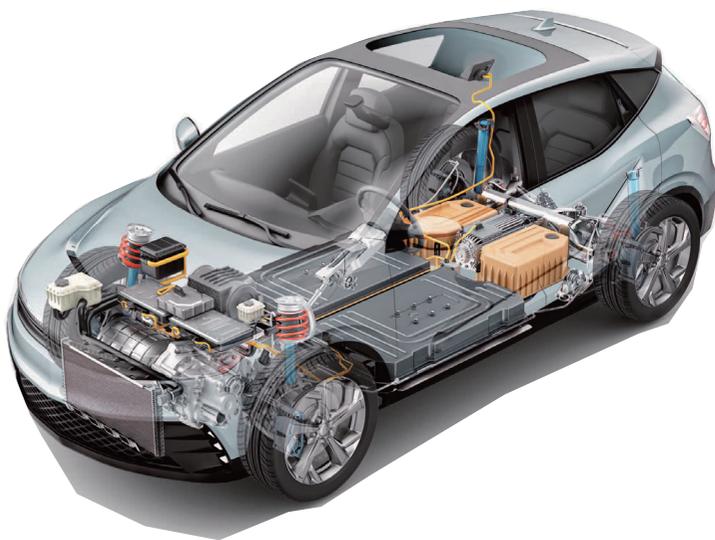
- Min-K
- WDS

Battery and Energy Storage

Our Energy Storage Technology (EST) portfolio developed with market leading innovation to provide unique solutions for mitigating thermal runaway.

The Thermal Ceramics business of Morgan Advanced Materials engineers, manufactures and supplies technologically advanced fibre and microporous materials to help the electric vehicle industry address complex thermal runaway and fire protection challenges.

With the recent consumer-driven demand to increase range and power, new platforms require their lithium-ion battery packs to have higher energy densities and improved thermal management. To assist battery pack designers in meeting these requirements, along with the need to pass current and future standards, we have developed a suite of EST™ solutions to provide cell-cell, module-module, and pack level protection.



Our EST product line has been specifically designed for lithium-ion systems to prevent or delay thermal runaway propagation. It comprises insulative, endothermic, and intumescent materials designed to optimize space and weight constraints without loss of safety and performance:

- The EST Compression paper family is designed to accommodate the expansion and contraction of pouch cells while providing enhanced thermal runaway protection
- EST M Paper is a mica-laminated paper designed to reduce convection and conduction in module-module and pack level applications
- EST E Paper is a flexible material designed to undergo a phase change to remove heat from a pouch, prismatic, or module thermal runaway event
- EST D Paper is surface treated on one side and developed for pack level protection in lithium-ion battery packs
- EST G Paper is a fibreglass encapsulated paper designed to be used for Prismatic cell, module and pack level thermal runaway protection
- EST P Paper is a composite product with a flame retardant heat sealing film commonly used in lithium-ion pack level protection

Fire Protection Products

FireMaster® products are used all over the world to protect people and structures against fire. The wide variety of FireMaster fire protection systems are comprehensively certified and extensively tested to meet national and international standards and have approvals valid worldwide for cellulosic, hydrocarbon and jet fire protection, offering our customers the security of global proven fire performance in various market sectors:

- Commercial Buildings, Hotels, Sports Stadiums and Airport Terminals
- Industrial Plants
- Petrochemical plants, Offshore Platforms and FPSO's
- Cruise Ships, Military Vessels, Mega Yachts and Fast Ferries
- Tunnels and underground construction
- Fire Rated (Fire Resisting) Duct work protection
- Fire doors, OEM and fire stops
- Renewable energy solutions such as windmill nacelles and offshore wind farms

Marine & Offshore and Oil & Gas

FireMaster systems have been providing for offshore platforms and chemical process plants fire protection for over 30 years with references in many major projects.

Ductwork

FireMaster duct wrap products are manufactured using Thermal Ceramics patented low biopersistent Superwool® fibres. FireMaster duct wrap products are completely encapsulated in aluminium foil. It is installed onto ductwork using band straps or CD weld pins to provide fire protection for up to two hours.

Tunnels, construction and industrial

Not only is there a risk to human life but also severe damage to the tunnel structure can occur, requiring extensive repairs or even causing collapse of the tunnel. The resulting disruption of transport links can cause serious economic or social problems such as increased traffic congestion, reduction in tourism or damage to local businesses.

FireMaster products also offer fire, thermal and acoustical fire protection in the construction and industrial markets and due to the lightweight flexible nature of the material, labor is significantly reduced during installation.

FireMaster Fire Protection products

- FireMaster Marine Plus Blanket
- FireMaster FastWrap® XL and XLS
- FireMaster DryerWrap™
- FireMaster PlenumWrap™
- FireMaster Cable Tray Wrap system
- FireMaster Enclosure System (FES & RES)
- FireMaster MP
- FireMaster Paper
- FireMaster Board
- FireMaster FB 100
- FireMaster FireBarrier™ 135



Product Data Book • Products and Systems

Thermal Management Solutions • Thermal Ceramics

FireMaster® product range includes:

FireMaster Marine Plus Blanket

Lightweight fire insulation designed for weight sensitive applications. Weight savings up to 30% are typical compared to standard FireMaster blanket and alternative insulation solutions. Systems are available for composite, steel and aluminium structures.

The blanket can be faced with Aluminium Foil, Glass Cloth, both or encapsulated with reinforced aluminium foil.

The blanket is also available with a water repellent treatment through the entire blanket thickness to inhibit water ingress.

FireMaster FastWrap XL and XLS

Fully foil encapsulated flexible blanket wrap system for fire protection of commercial kitchen grease extraction or ventilation ducts.

FireMaster DryerWrap

A flexible wrap system developed for dryer venting ducting in multi-unit housing where dryer exhaust ducting passes through multiple fire rated compartments before venting to outside the building.

FireMaster PlenumWrap+

A flexible wrap developed for reducing the spread of flame and smoke emission in a fire of plastic pipes or any structure carrying plastic coated cables. PlenumWrap provides highly efficient thermal insulation to maintain the pipe or cable coating temperature below the critical level at which flame or smoke propagation occurs.

FireMaster CableTray Wrap

FireMaster blanket totally encapsulated in aluminium foil. Approved by Factory Mutual for hydrocarbon fire protection of instrument and control cables.

FireMaster Enclosure System (FES & RES)

Beskope enclosure system for jet fire protection of valves, actuators, vessels and flanges. Can be supplied rigid or flexible.

FireMaster MP

Microporous technology providing the best insulation in the market. Can be flexible, rigid or semirigid.

FireMaster Paper

A thin, non-combustible and flexible fire insulation material ideal for use as a fire resistant gasket or similar uses in critical fire protection applications where a non-combustible product must be used, such as IMO A-Class fire rated constructions. An expanding version is available, typically to incorporate into engineered fire-rated components to provide a sealing function during fire exposure.

FireMaster Board

Three different grades of non-combustible rigid boards are available to offer designers a choice of products most suitable to their application.

FireMaster FB 100

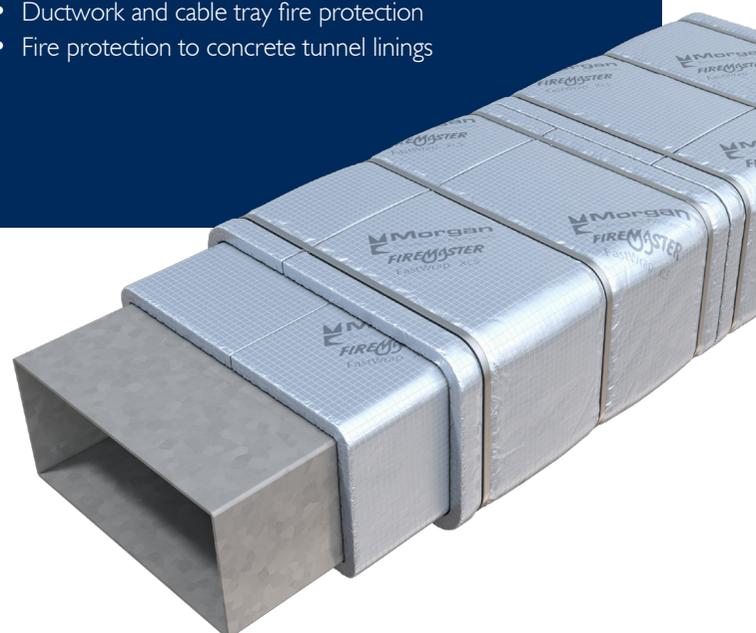
Spray-applied fire-resistive material for steelwork with UL 1709 listing.

FireMaster FireBarrier 135

Sprayed refractory cement solutions for fire protection of tunnels. Tested to RWS, HCM, RABT and ISO 834.

Applications

- 'A' class and IMO HSC steel, aluminium and FRP composite bulkhead and deck insulation in high speed craft
- Upgrading of fire performance of composite panels to meet IMO room corner test requirements
- 'JF' class, 'H' class and 'A' class steel bulkhead and deck fire protection for ships and offshore platforms
- Hydrocarbon and jet fire protection of process pipes & vessels including Cryogenic spillage and blast resistance
- Infill to fire doors and cladding panels
- Construction joints
- Cellulosic & hydrocarbon fire protection of structural steelwork
- Ductwork and cable tray fire protection
- Fire protection to concrete tunnel linings





Heat Shield Products

By employing a range of materials, Thermal Ceramics can provide heat shields in a wide variety of demanding environments across many markets and demanding applications.

Our Heat Shields are used within transportation and are often incorporated into shipping, aeronautical and automotive design. Depending on the specific application, our material engineers can develop and implement a high performance solution that meets your requirements. This is done by taking the unique properties of high temperature insulation such as ceramic fibres and microporous to produce heat shields that are highly adept in extreme environments, whilst retaining characteristics such as light weight and robustness.

Having worked extensively with shipping, aerospace and automotive industries in both commercial and defence spheres, we are ideally placed to provide you with Heat Shields that is on budget, without sacrificing performance.

Common insulation materials used in our Heat Shields:

- Superwool low biopersistent fibres (LBP)
- Glass Fibres
- Microporous materials

Common materials used for encapsulation:

- Austenitic and ferritic stainless steel
- Inconel
- Titanium

Heat Shield products

- Shell Tech
- Integrated Tech
- Flexible Tech
- Rigid Box Tech



Products and Systems

Thermal Management Solutions • Thermal Ceramics



Shell Tech

Designed to follow the shape of your equipment, our lightweight Shell Technology provides an elegant fitted solution to your thermal protection needs. Our Shell Technology is made using Superwool® Plus insulating fibre, FireMaster® fibre, silica, glass fibre or microporous insulation material completely encapsulated in stainless steel and custom-shaped to fit your application. This ensures the possibility for the customer to manage the final assembly on site. Shell Technology is made of corrugated SS in a thickness from 0.05 to 0.3 mm. Ideal where space is at a premium, Shell Technology is easy to fit, and easy to remove for maintenance or other reasons for applications including:

- Aerospace: thrust reverser
- Automotive: exhaust catalyst
- Passenger vehicles: exhaust manifold
- Off-Road vehicles: turbocharged
- Marine & power generation: exhaust manifold

Our heat shields made from our shell technology offer the following benefits to our customers:

- Elegant, fitted, lightweight solution
- Effective lifetime insulation
- Easy to fit and to remove

Integrated Tech

For the insulation of large or complex equipment, our integrated technology solutions are custom designed. Our integrated technology is made using Superwool Plus insulating fibre, FireMaster fibre, silica, glass fibre or microporous material, completely encapsulated in stainless steel and custom-shaped to fit your application requirements. This ensures that the assembly is made in Morgan's, Ecrans Thermiques with the part provided by the customer.

Integrated technology is made of corrugated SS in a thickness from 0.05 to 0.3 mm and provides excellent lifetime insulation for applications including:

- Aerospace: helicopter turbine
- Automotive: exhaust catalyst
- Passenger vehicles: exhaust manifold
- Marine & power generation: exhaust manifold



Flexible Tech

Our flexible technology provides an effective and versatile solution for thermal protection in a wide range of industrial and other applications. Made from silica or glass fibre encased in silicone and stainless steel fabric, our flexible technology offers heat shielding in continuous operating temperatures up to 600°C. A fully flexible jacket, it is lightweight and easy to fit, and to remove if necessary even in a restricted space.

Our flexible technology solutions are suitable for a wide range of applications including:

- Automotive: exhaust manifold
- Passenger vehicles: exhaust manifold
- Marine & power generation: exhaust manifold
- Oil & gas: valves & actuators

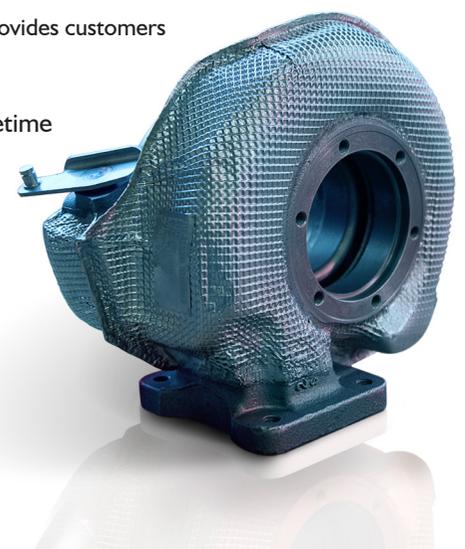
Rigid Box Tech

Our rigid box technology offers effective thermal and fire protection for all types of equipment, in an easy-to-use, SOLAS-approved and jet and hydrocarbon fire approved system.

Rigid box enclosures are custom-built to suit each application using FireMaster Marine Plus blanket or silica or glass fibre insulation material which is completely encapsulated in austenitic or ferritic stainless steel at our advanced manufacturing facility. Rigid box technology is made of SS in a thickness from 1 to 5 mm.

Our rigid box technology provides customers with the following benefits:

- SOLAS approved, lifetime insulation
- Jet and hydrocarbon fire approved
- Easy to fit and to remove
- No contact with insulation material
- No tooling required



Morgan Advanced Materials

Significant trends shape our modern world, accelerating the demand for new and more sustainable advanced materials.

At Morgan Advanced Materials, we use advanced carbon and ceramics materials to support the move to a more sustainable world. Our people are driven to solve complex customer problems: from managing heat and enabling greener technologies, to supporting improved medical diagnostics and protecting life.

Our purpose is 'to use advanced materials to make the world more sustainable, and to improve the quality of life'. This purpose is underpinned by our safe, ethical and inclusive culture, embraced by our 7,800 employees spanning over 25 countries. Working across many industries and in a number of markets, we deliver the materials science and technologies the world needs now.

Our Strategy

We are a global advanced manufacturing organisation with leading capabilities in three areas: materials science, application engineering and customer focus.

Our Business Model

We operate as two global divisions and three global business units. We empower our global business unit teams, giving them considerable autonomy and enabling them to act quickly and support their customer needs. Our broad manufacturing footprint enables us to supply customers locally from a short supply chain.

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