

**Advanced Thinking in Advanced Materials**



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NEWS RELEASE

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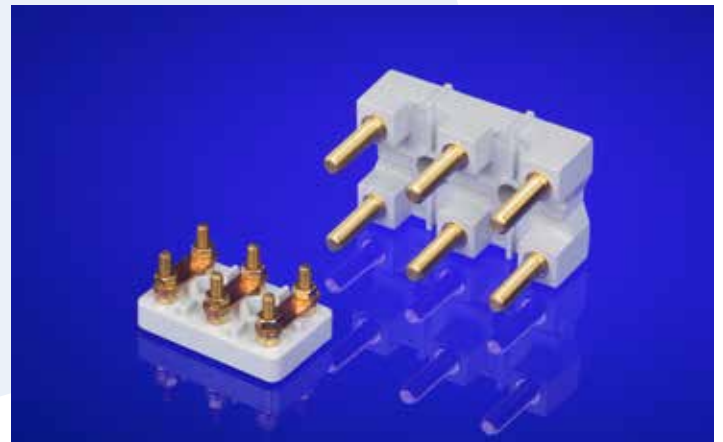
# Motor terminal blocks feature flexibility for electric grid connection of components in AC/DC motors

JULY 2015

The Electrical Carbon business of Morgan Advanced Materials, who hold a quality seal of approval from technical manufacturers and processors of typified plastic molding components, offers motor terminal blocks in a range of designs, to meet custom requirements. Utilizing glass fiber reinforced polyester compression molded components and pins suited to a wide variety of applications, Morgan's terminal blocks are used for electric grid connection of components in AC/DC motors. They feature conductive jumpers in a range of dimensions and bolt sizes (M3-M16, rated voltage from 440 to 2000 volts).

Terminal blocks are generally supplied without nuts, washers and links, but can be delivered assembled if requested by the customer. The wide product range of terminal blocks which are suitable for motor lead sizes from 2.5 square millimeters (mm<sup>2</sup>) to 25 mm<sup>2</sup>, includes options which are explosion-proof to 690 volts. Most frequently used UL certified molding materials include PF31, UL804, UL3415, and UL4385.

The terminal blocks are manufactured in a facility certified to ISO 9001:2008 and meet the European Union's ATEX directives, which specify the equipment which is acceptable in an environment with an explosive atmosphere



# Versatile Superwool® Sealcoat™ HT mastics highlighted by Morgan's Thermal Ceramics business

JULY 2015

The Thermal Ceramics business of Morgan Advanced Materials has developed a versatile fiber, Superwool® Sealcoat™ HT, which is suitable for use in nearly a dozen furnace lining applications. From primary liner to emergency repairs, and backup insulation to patching, the mastics are a perfect complement to Morgan's range of fiber and dense refractory materials.

Specially formulated to provide the high level of atomization required for spray application, Superwool Sealcoat HT can be applied as part of the primary liner over fiber or refractory surfaces, up to 2 inches (5.1 cm) thick on walls and up to 1/2-inch (1.3 cm) overhead. Installation requires no chemical cure-out, so lining can be fired immediately after installation. Once dried, the material provides a strong hard surface, while still maintaining resiliency.

Repairs capability is another strength for Superwool® Sealcoat HT. For emergency repairs to cracked walls or spalled floor jams, Superwool® Sealcoat HT can be applied over hot refractory or hot fiber surfaces. The material also works well as a caulk for repairing large gouges in reheat furnace and ladle preheat stations, and for filling shrinkage gaps and damaged areas in linings. It is also ideal as a patching material for aluminum trough and launder repair, and vacuum-formed shape repair.

As a backup insulation, Superwool® Sealcoat HT can be applied to a steel shell in place of insulating board or paper, prior to installing the working lining. Its use avoids the need to cut and fit insulation around pre-welded anchors. It can also be used as an

adhesive for installing backup board on an induction furnace. With almost no rebound, very little waste is generated and no overage is required. After installation, site clean-up is also greatly reduced

Superwool® Sealcoat HT can also be used in joint sealing, gasketing, and as a hot-face veneer coating to improve a lining's thermal efficiency. Demonstrating the numerous other applications for this multipurpose material.



# Morgan offers world leading portfolio of silicon carbide materials for sliding bearings and seal faces

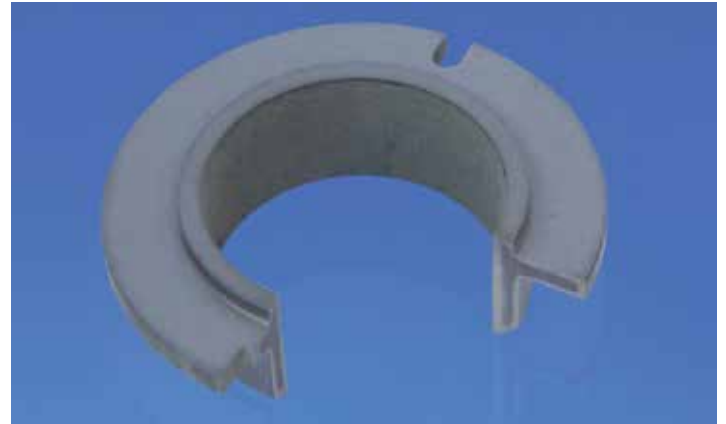
JULY 2015

The Seals and Bearings business of Morgan Advanced Materials manufactures the world's leading portfolio of silicon carbide (SiC) materials, from siliconized graphite to graphite-loaded silicon carbide hybrids. Morgan offers a range of materials ideal for abrasive applications in the oil and gas, chemical processing, and automotive industries. The materials include the original siliconized graphite, plus both monolithic and graphite-loaded versions of reaction bonded and self-sintered SiC.

With more than 70 years of experience developing high duty friction and wear materials for both sliding bearings and seal components, Morgan's siliconized graphite materials set the bar for mating pairs over thirty years ago, in terms of abrasion resistance and load carrying capability.

In the past few decades, Morgan has led the industry in developing the next generations of tribological materials that offer improved strength and hardness, abrasion and corrosion resistance, stiffness, and performance.

With its extensive portfolio of both mechanical carbon and silicon carbide materials, Morgan's Engineers help customers to evaluate materials in order to select the right one for a particular application.



## Morgan Invests in the Semiconductor Market

JULY 2015

Morgan Advanced Materials has made a further major investment in its capability for manufacturing semiconductor processing products, at its Technical Ceramics facility at Rugby in the UK.

The investment confirms Morgan's ongoing commitment to optimising its manufacturing capabilities in order to best serve its growing global customer base.

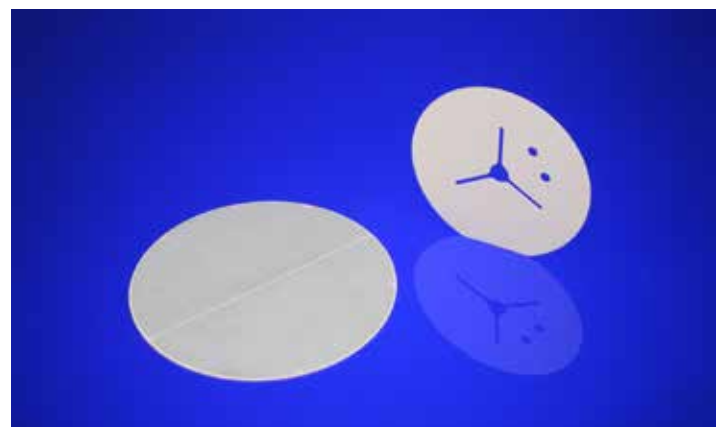
In particular, capital investment in new grinding equipment and an additional kiln has significantly increased Morgan's capacity. Semiconductor processing equipment is an area where Morgan has been performing particularly well recently and is seen as an area of growth for the company. As a result, Morgan is now better equipped to take on larger scale projects, supporting its ambitious growth objectives.

Through this investment, Morgan's Technical Ceramics business is now capable of precision grinding products of up to 500mm in diameter and 600mm in length, or longer lengths with smaller diameters, and manufacturing complex brazed assemblies incorporating its own metallisation inks.

The investment was made in response to increased demand for high purity alumina products from the semiconductor industry, but also from the medical and aerospace sectors. Products for the semiconductor industry include end effectors for efficient wafer handling, inductively-coupled plasma chambers / plasma focus tubes, ring spacers and electrostatic chucks (ESCs), which can be supplied either metallised or bare in diameters up to 450mm. Morgan's proven range of high purity materials are eminently suitable for use in high vacuum environments because they do not outgas.

With more than 60 years of experience in supplying premium custom ceramic components, Morgan has unrivalled experience of meeting the needs of the semiconductor industry. While it has the capability to create innovative engineered solutions for its customers on a batch and high-volume basis, it also has the expertise to competitively develop and produce high-quality prototypes to customer specifications, enabling semiconductor manufacturers to optimise their processes, maximise yields and reduce costs.

Phil Shakespeare, Engineering Manager, commented: "Our technical expertise and increased manufacturing capability enable us to deliver innovative, high-quality products to the market. We are the ideal choice for customers who need us to create bespoke solutions - our team of materials scientists and technical engineers have the know-how to work with customers to develop technical solutions for the most demanding applications."



# Halfoam™ joins Morgan's extensive portfolio of porous materials

JULY 2015

Morgan Advanced Materials has further extended its range of porous materials with the launch of HalFoam, alongside the introduction of new grades within existing product lines.

Haldenwanger® HalFoam™ is foaming technology which create a porous surface for aluminium oxide (alumina) and fused silica base materials and offer total porosities of up to 80 per cent. HalFoam™ Alumina, ideal for use within kilns, performs at temperatures up to 1,700°C, while HalFoam™ Fused Silica has demonstrated thermal insulation properties of between 500°C and 1,000°C.

Michael Rozumek, R&D Director for the Haldenwanger® products business at Morgan Advanced Materials explains: "Over the past two years, Morgan has made a considerable R&D investment into our porous materials portfolio. Our porous extruded products, with porosities ranging from five per cent up to around 40 per cent, can be used in a multitude

of high-temperature applications where thermal shock is of particular concern. The introduction of the HalFoam™ products further extends our capabilities, offering up to 80 per cent porosity and enhanced protection for surfaces in environments which experience rapid temperature change."



# Morgan introduces new ultrasonic sensor solution for food & beverage sector

JULY 2015



Morgan Advanced Materials has created a ground-breaking ultrasonic sensor solution for use within the food & beverage sector.

Higher operating temperatures and pressures, in addition to the presence of steam and potentially corrosive products such as alcohol and solvents, require robust measuring components that can function correctly under demanding conditions. Similarly, with the drive for smaller machine footprints, there is an increased demand for sensors that take up less space.

All of these factors have influenced the design of the new sensors, which will enable manufacturers to enjoy optimum performance across a variety of applications.

Featuring a stainless steel or alumina outer design, Morgan's ultrasonic sensors optimise performance while complying with stringent food

safety regulations. In applications such as milk metering and beverage dispensing, accurate sensing is key to ensure the correct filling of containers. However, due to space restrictions, ultrasonic metering is an excellent choice to increase accuracy and preserve a small footprint.

Morgan's ultrasonic sensor supplies into ultrasonic meters which use solid state technology with no moving parts, thereby eliminating any concerns about smaller particles breaking off and entering the fluid being processed, which could have potentially serious consequences for both the end user and process. Furthermore, the use of chemically inert materials means the sensors will not be adversely affected by the presence of alcohol or solvents.

Charles Dowling of Morgan Advanced Materials commented: "We have designed a solution that will make systems designers' lives much easier. Our ultrasonic sensors can cope with the most demanding of conditions without unduly imposing on the production process and crucially, without the premium price tag.

"With high sensitivity, wide bandwidth and stable electrical properties demonstrated even at very high temperatures and pressures, our sensors are pushing the boundaries for ultrasonic metering in these highly demanding conditions".

Ultrasonic sensors have a variety of other uses. For instance, they can be discreetly placed within gearboxes to provide real-time information on coolant or lubricant levels, allowing users to make informed decisions on when a top-up or replacement is needed, minimising downtime and disruption in the process.



# Customized laser reflecting products from Morgan offer high reflectance over a wide wavelength range

JULY 2015

The Technical Ceramics business of Morgan Advanced Materials announces that it has expanded its capabilities in producing standard and customized high reflectance ceramic cavities in laser reflectors. High performance alumina-based ceramic reflectors for solid-state lasers are ideal for a wide variety of industrial and healthcare applications, including cutting and welding, marking, or even hair and tattoo removal. Morgan's proven Sintox AL material, a porous high purity alumina (99.7 percent Al<sub>2</sub>O<sub>3</sub>), boasts high strength, good thermal conductivity and excellent dimensional and electrical stability in the operating temperature range.

Longer lasting and featuring high reflectance over a wide wavelength range, Sintox AL provides a cost effective alternative to metal-coated reflectors. It exhibits high reflectance (97-99 percent) over an optimum reflectance range from 570-2000 nanometers (nm). Process control and repeatability allows production of material with controlled porosity – a necessity for high quality laser light generation.

Morgan offers three proprietary glaze options that protect the underlying porous ceramic from cooling fluids in operation and can be colored to restrict wavelength range. A clear yellow glaze absorbs radiation at the Nd-YAG lasing wavelength of 1064 nanometers (nm), and further transitions near 940nm, 1120nm, 1320nm and 1440nm. A high-absorption samarium

oxide glaze is formulated through controlled addition of dopant to create optimum reflectance properties. The samarium oxide glaze matches yellow and clear glazes between 700-900nm for reflectance.

With the design capability to produce customer-specific solutions and standard products, Morgan offers one piece, two-piece and complex geometries. Components up to 250 millimeters (mm) long and with diameters up to 80mm are manufactured as standard.



# Arc protection system for current collector strips offered by Morgan improves reliability and service life

JULY 2015

Morgan Advanced Materials announces a new lighter weight, metalized current collector strip (pantograph), offered by its Electrical Carbon business, which enhances rail system reliability and extends service life by about 35 percent. The new collector strips boast an arc protection system, which maximizes collector strip life, reducing maintenance and running costs for rail contractors. The system also provides improved service for passengers, since the collector strips require less frequent replacement, drastically reducing downtime.

The new lighter metallized collector strips are the latest addition to Morgan's line of performance carbon and metalized carbon current collector strips for pantograph and third rail applications. The comprehensive range of collectors includes products suitable for overhead, third rail and trolley bus shoes in transportation applications including; metro systems; high-speed trains; trams and trolley buses.

The new collector strips are based on proprietary material technology which enables the strip's width to be increased by 40 percent, from 30 millimeters to 42 millimeters. The arc protection system, an engineered coating applied to the metal, draws any arcing to the

carbon strip. This makes the strips ideal for running in wet weather or icy conditions, when a buildup of ice on overhead rail lines creates a barrier to power transfer and may cause localized overheating of the metal support carrier. Without arc protection, collector strips must often be replaced before the carbon has fully worn.

The new collectors join a line of Morgan products designed, engineered, and manufactured for mainline railway systems, including self-supporting carbon collector strips that feature epoxy bonding of carbon to aluminum. These self-supporting carbon collector strips reduce pan head mass, improve dynamic response, and reduce maintenance and service costs. In addition, Morgan has developed a unique method of transferring high currents to give a low resistance current path in bonded collectors, resulting in an innovative lightweight solution for DC applications. Also offered are auto drop collector strips, an impact detection system within the collector strip that enables the pantograph to be lowered if severe impact occurs, preventing additional damage.

# Morgan offers high quality gold assay furnaces, crucibles and cupels

AUGUST 2015

Morgan Advanced Materials offers gold assay fusion and cupellation furnaces, crucibles, and cupels, ideal for quantitative and qualitative analysis of mined ore samples in the gold mineralization industry. Morgan's excellent manufacturing quality, superior technical service and responsive lead times, have led to recognition as a leader in the supply of crucibles to non-ferrous metals industries worldwide.

Traded under the Furnace Industries brand, the gold assay products are manufactured in two of Morgan's Western Australia facilities, which represent the company's center of excellence for gold mining. The manufacturing sites meet ISO 9000 quality standards and are staffed with expert engineers. One site produces high quality, custom-designed furnaces while the other specializes in producing crucibles and cupels on a high speed production line.

Morgan's gold assay furnaces, crucibles and cupels are an excellent choice for both exploration multi-sample testing, to determine a mine's potential and for quality control grade tests, to ensure consistent gold content levels in material sent to mills.

Morgan's innovative designs focus on energy and process efficiency, reflecting a deep understanding of energy losses

from furnaces and the needs of the gold assay laboratory. Furnace designs also incorporate new heat resistant and fire retardant products, including Superwool® insulation.

Experienced furnace engineers have developed burner technology which displays high levels of efficiency, allowing Morgan to differentiate itself with high levels of technical service. Morgan provides prompt troubleshooting and expert advice and offers off-the-shelf availability of spare parts with immediate dispatch, superior after sales parts service, and 5-6 week lead times.



# Morgan develops passive piezo sensors for detecting and measuring impact forces

AUGUST 2015

Morgan Advanced Materials announces its range of passive piezo sensors, ideal for detecting and measuring impact forces. Using a range of softer Navy type II and custom high sensitivity materials with excellent stability and high sensitivity, Morgan's engineers work closely with customers to design accelerometers, impact sensors and wheel or rotor balancing sensors.

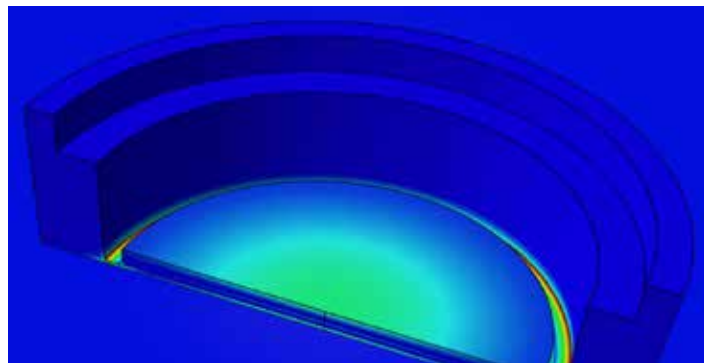
Throughout the development process, Morgan's experts focused on designing custom solutions for application-specific requirements, with an emphasis on ensuring that the end product integrates with existing systems. Morgan's production process can demonstrate traceability throughout the entire manufacturing line, enabling the production of cost effective products with exceptional quality, performance, and reliability.

With their excellent stability and high sensitivity, Morgan's passive piezo sensors have been successfully used for accelerometer sensors to measure vibration in aerospace applications. Used in compression or shear mode to form single or multi-axis accelerometers, sensors are offered with both standard and customer-designed housings. For higher levels of sensitivity, Morgan offers a range of bimorph materials.

The passive piezo sensors are also ideal for impact sensing applications, including sensors within vending machines that can accurately sense coin types based on the nature of the strike. The

precise tuning of the ceramic and assembly geometry generates a signal, which in turn can be used to determine the nature of the strike or the hardness of the material. Morgan works closely with its customers to optimize impact sensors for consistency of response in a variety of conditions. Customer-specific solutions can be developed using finite element analysis (FEA) software and solid modelling for accurate and detailed designs.

Morgan also offers sensors for dynamic force measurement, used for wheel balancing equipment as well as measuring the force exerted on the brake pedal during brake tests. Sensors are available for easy installation in a variety of devices and can be supplied with exposed (solder compatible) connectors or with customized cables and connectors.



# Morgan Advanced Materials to unveil latest in Soldier Systems at DSEI 2015

AUGUST 2015

Morgan Advanced Materials is to launch its Lightweight Armoured Soldier Architecture (LASA) - a complete portfolio of advanced protection systems designed to address the varied needs of modern combat personnel - at The Defence and Security Equipment International (DSEI) 2015.

The portfolio builds on decades of design expertise and generations of combat proven products. The LASA systems incorporate the latest hybrid composite materials technology, tuned to specific operational requirements. They have been developed at Morgan's Ballistics Centre of Excellence in the UK.

The DSEI event, which will take place at the ExCel arena in London from 15th - 18th September, will see Morgan unveil the latest innovations in its Special Operations range of helmets and body armour designed to offer the ultimate in protection and agility, with significant weight savings.

Showcasing the latest developments in lightweight composite technology, the LASA AC915, Morgan's newest high-cut assault style helmet provides outstanding ballistic, blunt trauma and back face deformation characteristics, as well as full compatibility with a range of accessories including night vision goggles, cameras and torches. Morgan is also unveiling technology that integrates a data and power network into the helmet shell. This integrated network reduces the complexity and burden of "add-on" battery packs and wiring harnesses.

The ballistic inserts harness Morgan's market-leading ceramic technology and patented Crack Mitigation System, affording the user a level of protection exceeding the requirements of NIJ Level IV at 2.2kg (4.9lb) per plate. Similarly, despite weighing less than 1kg (2.2lb), the lightweight buoyant LWB III+ plate offers unrivalled protection which exceeds NIJ Level III performance levels.

The Maritime system, jointly developed by Morgan Advanced Materials and Gecko Head Gear, is comprised of the Marine Ballistic Helmet and lightweight buoyant LWB III+ plates. The helmet's water resistant, buoyant, outer layer draws on Gecko's expertise in crew, marine and coastguard helmets and leverages Morgan's state-of-the-art technology to provide ballistic protection.

The marine system utilises Morgan's lightweight buoyant LWB III+ ballistic insert to deliver ballistic protection at and above NIJ Level III (with approved soft armour) at less than 1kg (2.2lb) per insert.

The Combat Operations system, delivering unrivalled protection in main infantry applications, includes a full cut LASA AC914 helmet to provide additional coverage than that typically provided by Special Operations' high cut variants. It also includes

the latest in hybrid protection technologies to reduce burden and ergonomically designed adjustable retention systems and high performance but comfortable blunt trauma protection.

Chris Davies, Technology Director at Morgan's Composites and Defence business, explained: "There is always a balance between protection and mobility, yet both are absolutely vital and cannot exist without the other. We have conceived a versatile range of solutions that deliver superior performance without compromising comfort and mobility to suit the full range of operations encountered by modern military and law enforcement agencies. This is just one of the new product ranges which we are launching this year and confirms Morgan's position as a leader in ballistic and blast protection technology".

The complete suite of world leading LASA soldier protection systems, Silverback™ bomb disposal suits and CAMAC platform armour will be available for viewing and trialling at the Morgan Advanced Materials stand (S5-275).



# Morgan to showcase breakthrough repair techniques at major global aerospace event

AUGUST 2015

The very latest in specialist maintenance repair & overhaul (MRO) techniques for the aerospace sector will be showcased by Morgan Advanced Materials at the 2015 Aero Engines Europe event, which will take place at the Paris Charles de Gaulle Airport Marriott Hotel on 21-22 October.

This will be the first time that Morgan will exhibit at this event, which brings together leading players from across the aerospace engine manufacturing and MRO sector to discuss current trends and issues.

Morgan is a global leader in the use of pre-sintered preforms (PSPs) for the repair of turbine components, with this capability now extending to cover bearing repair, rotating component restoration and aerofoil preforms. These require the use of complex three-dimensional preforms, an industry first resulting from Morgan's continued commitment to research and development and partnerships with global aerospace OEMs.

Luca Leone, Business Development Lead explained: "The cost of manufacturing engine components such as turbine blades and vanes is considerable due to the specialist materials involved and the complex casting processes required. This means that aircraft operators and maintenance specialists are unwilling to countenance the loss of an in-service component,

making effective repair techniques absolutely critical. "Morgan pioneered the use of PSPs in the repair of turbine blades – a process which has ensured that thousands of these components which might previously have been discarded have remained serviceable. This repair process has also been adapted to cater for more complex geometries and so is enabling drastic reduction in turnaround times for turbines, sometimes by as much as 50 per cent.

"We are seeing strong interest in these highly innovative techniques from the major global aerospace OEMs and Tier 1 suppliers, who are looking for every opportunity to drive out cost from the supply chain and extend service life."



# Morgan adds standard-sized brazed ceramic filament supports to growing product range

AUGUST 2015

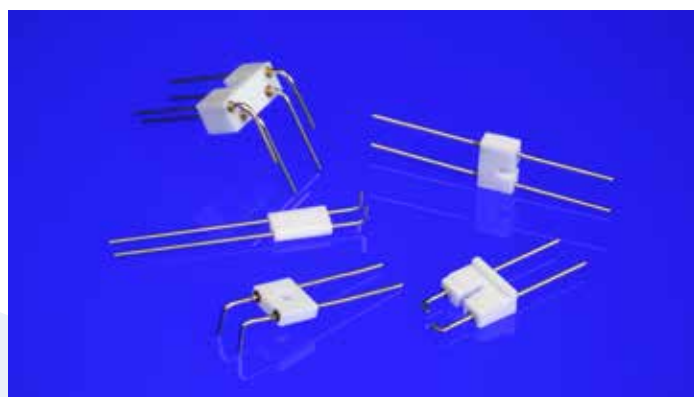
Morgan Advanced Materials has announced plans to launch its own range of standard brazed filament supports, complementing its existing portfolio of high-specification products.

The world leader in advanced materials will draw upon more than 30 years of manufacturing expertise to respond to the growing demand for standard-sized filament supports within the analytical market, enabling a greater degree of flexibility and responsiveness to evolving customer requirements. The availability of standard components means significantly shorter lead times, giving Morgan's customers the added option of an 'off the shelf' solution.

Used in x-ray and analytical equipment, predominantly in the medical and scientific research sectors, Morgan's brazed ceramic filament supports are available in standard and custom shapes, in small and large volumes. The standard range is produced using Morgan's proven high purity alumina grade Sintox FF. Compared to alternative materials, ceramic boasts optimal thermal and electrical insulation, a low coefficient of thermal expansion and superior dimensional accuracy. Customers can choose between two and four-pin options, with the pins brazed in position with ceramics for filament welding. Custom designs are also available to suit specific requirements, incorporating

variations in pin size, form and material. A variety of braze materials can be used, including gold nickel, gold copper and silver copper eutectic.

Suhan Wang, Efficiency and Process Engineer at Morgan, commented: "We are always keen to investigate innovative ways to adapt to the changing needs of the market and by offering standard ranges, we will be able to respond more quickly to customer requirements while still offering customised designs when needed. A range of material grades are available for custom products, depending on the requirement."





# New Chief Executive at Morgan Advanced Materials

AUGUST 2015



Pete Raby is the new Chief Executive Officer at global materials technology specialist Morgan Advanced Materials.

Pete, 47, has more than 20 years' industry experience and joins Morgan from aerospace and defence component manufacturer Cobham plc, where he led the company's Communications and Connectivity division.

During a nine-year spell at Cobham, he held a number of other senior roles including head of strategy, chief technology officer, and leader of the group-wide "Excellence in Delivery" operational transformation programme.

He takes over from interim CEO Kevin Dangerfield with a brief to continue to develop Morgan's business across its key target sectors which range from healthcare and electronics to transportation, energy, security & defence, industrial and petrochemicals.

## Morgan announces robust brazed assemblies for medical imaging applications

AUGUST 2015

Morgan Advanced Materials announces the availability of brazed assemblies for medical imaging applications using ceramic insulators. Assemblies are manufactured with proprietary grades of high purity alumina ceramic with superior electrical and dimensional stability across a wide temperature range. Morgan's ceramic-to-metal assemblies for imaging components include high voltage insulators for CT scanning equipment, anodes and cathodes, filament insulators, getters and headers, as well as ceramic components used in vacuum tubes for x-ray equipment. Morgan's materials and manufacturing process result in better seals with maximum hermeticity for high performance and extended life cycle. Advanced ceramics also allow higher voltages, which result in higher power and improved image resolution.

By producing components in a vertically-integrated manufacturing process, Morgan controls process, quality and cost. Along with Morgan's materials expertise, they offer in-house powder preparation, ceramic forming, ceramic sintering, metallisation, electroplating, assembly, and brazing.

Pete commented: "It is a privilege for me to take on the leadership of this great company – a world leader with a strong history and, I am confident, a great future. Morgan enjoys a strong reputation, underpinned by distinctive capabilities in materials science and technology, as a business with outstanding products and solutions, dedicated employees and excellent customer relationships.

"We are known as a materials science business and that is why customers choose to work with us. Last year we invested £21.7million – more than 2% of our revenue - in technology development and we will continue to invest in our future.

"Our continued growth and success will be determined by meeting our commitments to customers - delivering high-quality products and services where they are needed, on time, every time."

Morgan Chairman Andrew Shilston added: "Pete has a strong technical background and an impressive track record in planning and executing business strategy across global manufacturing operations.

"His background in technology-led innovation makes him an excellent choice for the role of CEO as Morgan Advanced Materials continues to develop truly differentiated, world-leading products and materials across its global markets." Founded in 1856 and listed on the London Stock Exchange, Morgan today has operations in more than 50 countries. It manufactures a wide range of specialist, high-specification materials with a range of attributes and properties which deliver exceptional performance, often under extreme conditions.

Inspection, testing and cleaning processes dedicated to imaging components are also available. By controlling every aspect of the manufacturing process Morgan ensures that all customer components are fully tested and certified, and meet all material traceability requirements. Use of rapid prototyping and machining capabilities reduces tooling requirements, which reduces lead times by as much as 50 percent.

Products made from Morgan's high purity alumina grades are far stronger and more durable than those that use glass as an insulator. They offer higher strength and better electrical characteristics making them highly suitable for the high voltages used in power tubes. They are also better able to withstand rotational forces to which the imaging tube is subjected.

Brazing ceramic to metal results in a reliable hermetic seal – hermetic to less than 10(-9) atm cc/sec He. The materials can also be lapped to very tight tolerances and can be produced using isostatic or dry pressing, and can be manufactured in prototype, batch or volume production.

# Ensure maximum flexibility with REKOFA® slip ring transmitters for surgery lamps by Morgan

AUGUST 2015

Morgan Advanced Materials announces that its Electrical Carbon business offers slip ring transmitters ideal for carrier systems used in operating theatres and intensive care wards. Guaranteeing continuous rotation of the central axis and spring arm, the slip ring transmitters ensure maximum flexibility. The extremely compact, durable, and lightweight products are developed to customer-specific requirements by a team of design engineering and development specialists, dedicated to offering customers the best possible solutions.

The outer diameter of the housing of the REKOFA systems, also known as rotary couplings, measures between .87 and 3.15 inches (22 and 80 millimeters). The central axis has a free internal diameter of 1.97 inches (50 mm). The systems have a guaranteed service life greater than 10 years. In addition to 230 volts/10 amps, the slip ring

transmitters also carry HD video signals, and are UL certified. Morgan's in-house testing ensures that critical signals are transmitted fault-free through surface-refined mating contacts.



# Enhance automation flexibility and save costs with REKOFA® slip ring transmitters by Morgan

AUGUST 2015

Morgan Advanced Materials announces that its Electrical Carbon business offers slip ring transmitters that help enhance automation flexibility by enabling construction of half a dozen vehicle derivatives on a single line. The REKOFA® slip ring transmitters, also known as rotary distributors, have been approved by more than 30 automotive original equipment manufacturers around the world.

Morgan's REKOFA 100 megabit per second (Mbit/s) continuously rotating over slip ring transmitters can considerably reduce cycle times, making them extremely cost effective compared to alternatives such as drag chains.

The product can be mounted on a turntable, rotating drum, or robot axis, ensuring the supply of data, current, and media to downstream components, including tensioning units and manifolds. Slip ring transmitters offer enormous programming scope, while requiring little or no maintenance, with a service life of up to 200 million revolutions. Their use also eliminates the need for a drag chain, removing the cost of servicing the drag lines.

Using repeaters integrated into the slip ring transmitters permits central monitoring of all components by system operators. The transmission and reception quality of the data is therefore accessible at any time, because the distributor is visible as a device on the network.

Morgan also offers hybrid rotary distributors, in which currents and media are transferred in tandem, enclosed in housing with an environmental protection class of up to IP68. With this option, power is distributed by contact. When used with a welding

turntable, the current flows from the switch cabinet through the table axis to static metal rings known as slip rings. From there, contactors draw off the power from the rings while the table is turning. Connectors distribute the power to the items on the table.

The REKOFA rotary distributors are used with plastic optical fiber (POF) cable, ensuring safe transmission of sensitive data, even to welding systems. Media is also transferred in endless rotation, with special gaskets tailored to the specific medium. Standard media includes air and water, but oil, fuel gas and adhesives, including those used in window gluing systems, can also be combined in hybrid rotary distributors.



# Morgan Advanced Materials in full flow with ultrasonic transducers for gas flow measurement

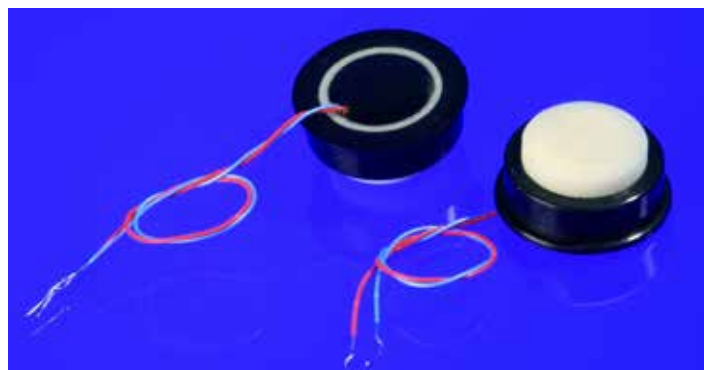
SEPTEMBER 2015

Morgan Advanced Materials is set to launch a new Ultrasonic transducer for measurement within the residential and industrial gas metering sector, optimising energy efficiency by offering customers greater transparency of energy consumption.

Drawing on its world-leading expertise in sensor and transducer technology, this latest development from Morgan boasts unrivalled measuring precision, making it ideal for use in industrial flow sensing. With its pioneering use of solid state technology, this transducer offers greater accuracy over time compared to alternative technologies based on moving parts which, when continually subjected to pressure, are vulnerable to wear and tear, impacting on measurement accuracy. An additional benefit of using ultrasonic technology is that meter readings can be taken wirelessly, providing convenience and ease of use for the end user.

To put this technological advancement into perspective, the new model has five times the sensitivity of its predecessor, an increase of 14db, and can withstand pressures of up to 100bar without compromising on accuracy.

Ewan Campbell of Morgan Advanced Materials commented: "Once again, Morgan is increasing sensitivity and pushing boundaries in terms of measurement performance in high-pressure gas pipelines. Our transducers are ideal for measuring highly attenuative materials such as high concentration methane, accurately and consistently, over a long period of time. By equipping customers with the means to accurately monitor energy consumption, they will be able to regulate energy usage and reduce energy-related expenditure in the process."



# Morgan develops monolithic refractory products with 20 percent improved insulating properties

SEPTEMBER 2015

Morgan Advanced Materials announces the availability of their new insulating refractory monolithic products for a wide variety of high-temperature applications. These lightweight refractory castable materials can be easily installed using casting or gunning, giving them the flexibility to meet the needs of demanding environments, including petrochemical applications.

New Kaolite® 1800 Gun and Kaolite 2000 castables feature insulation that has been improved by 10-20 percent, while reducing density by 10 percent. The new formulations have densities between 25 and 35 pounds per cubic foot (PCF), maintain excellent cold crushing strengths, and can be gunned with minimal rebound loss.

Kaolite Super HS Gun is a new medium weight insulating castable, which features exceptionally high crushing strength, >2000 PSI in an 80 PCF density material. It also provides very good insulating properties, thermal shock resistance and can be easily installed by gunning.

Kaolite 2800 and Kaolite 2800 Gun formulations have been redesigned to feature higher strengths and better flow with reduced water additions, providing a better overall application performance. They are ideally suited for petrochemical applications that require reduction of supporting furnace steel work, as

the formulation provides more insulation with a thinner lining.

Morgan Advanced Materials offers a comprehensive monolithic materials range, from lightweight insulating, to clay bonded, to special duty. These products are enhanced beyond the scope of conventional monolithics, featuring properties such as additional strength and chemical damage resistance. They deliver a long, low-maintenance lifetime of service, even in the most demanding applications.





# Morgan expands supply capability of laser components in Europe

SEPTEMBER 2015

Morgan Advanced Materials, the global leader in specially-engineered ceramic materials for industrial applications, has extended its laser equipment manufacturing capability and product portfolio in Europe. Two of its European production facilities are now working in close collaboration, allowing Morgan to provide a comprehensive package for existing and prospective customers.

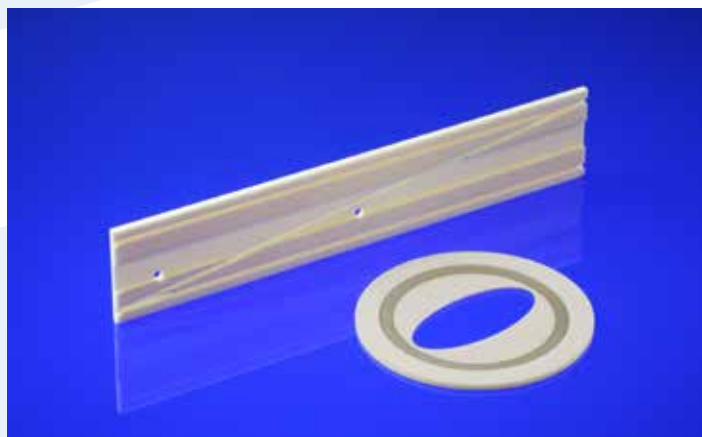
The two facilities, based in Rugby, UK and Erlangen, Germany, are combining their technological and manufacturing expertise, drawing on Morgan's unrivalled range of proprietary materials to deliver an enhanced portfolio of products including laser reflectors, ceramic-to-metal feedthroughs, and waveguides.

Used predominantly in laser pumping cavities in solid state lasers, Morgan's laser reflectors are primarily composed of Sintox AL alumina, a purpose-designed material with a porous structure used for its high reflectance properties over a range of wavelengths. Its feedthroughs are best suited to a range of applications such as ionisation, water-cooled electrical connections and trigger assemblies for gas lasers. Ceramic waveguides are incorporated into CO<sub>2</sub> lasers, where the reflective and refractive properties of the Deranox 970 and AL300 materials used assist with creation of the light beam in the chamber. They are designed to have compact size, helping to minimise machine footprint.

This collaboration will facilitate the exchange of knowledge and best practice that will optimise technological capability of the two sites. Also, as Application Engineers integrate their understanding of the market requirements, they will be able to enhance and expand Morgan's offering to its customers.

Oliver Ridd of Morgan Advanced Materials commented: "Rates of growth in the laser reflector business have been favourable this year and with steady growth expected into 2016, we are continuously taking steps to improve our manufacturing capability, to satisfy thriving global demand for laser product components. As part of Morgan's continued expansion, we are welcoming enquiries for larger, more complex projects.

By working together, our facilities in Rugby and Erlangen aim to harness expertise across both businesses in conjunction with our shared understanding of customers' requirements to deliver unrivalled levels of service. We now offer a larger portfolio of components and assemblies for laser applications, custom designed in collaboration with our customers."



## New Kiln furniture can handle temperature up to 1,500°C

SEPTEMBER 2015

Morgan Advanced Materials has once again responded to industry demands with the launch of a range of kiln furniture made from a new high-performance nitrite-bonded silicon carbide material suitable for use at temperatures of up to 1,500°C (2,732°F).

The material, known as Halsic-N, combines the properties of proven materials such as silicon carbide (SiC) and silicon nitride (Si<sub>3</sub>N<sub>4</sub>) in a microstructure which delivers strength, excellent refractory properties and resistance to oxidation and thermal shock.

Standard designs available include setter plates, beams and supports in a range of sizes, while components can also be manufactured to meet customers' own requirements.

Thermocouple protection tubes made from Halsic-N are ideal for the melting of non-ferrous metals such as aluminium and magnesium, where its strong metal-repelling characteristics

help ensure long service life and optimum performance.

With flexural strength of 160MPa, Halsic-N can even be coated with a specially formulated coating for the firing of porcelain or technical ceramics. Dr. Michael Rozumek, R&D Director at Morgan's Haldenwanger facility, explained: "Kiln furniture is subject to intense demands on its performance including rapid heating and cooling, making materials choice and design absolutely critical.

"Following extensive testing and analysis, our team of engineers has arrived at a formulation which we believe delivers all of the key performance attributes demanded by kiln users. With an extensive standard range and the ability to form shapes to meet customers' own design needs, we believe Halsic-N is set to become the material of choice for kilns across a broad spectrum of applications."



# Morgan highlights WDS® UltraShell solution, ideal for high temperature pipe insulation in energy sector

SEPTEMBER 2015

The Thermal Ceramics business of Morgan Advanced Materials announces the availability of its WDS® UltraShell™ microporous insulation, whose superior insulating properties make it ideal for energy sector applications demanding hot piping, including power plants, refineries, and renewable energy facilities. Morgan's Porextherm® WDS UltraShell solution enables the construction of smaller, lighter, and more cost-effective double wall "pipe in pipe" hot piping applications.

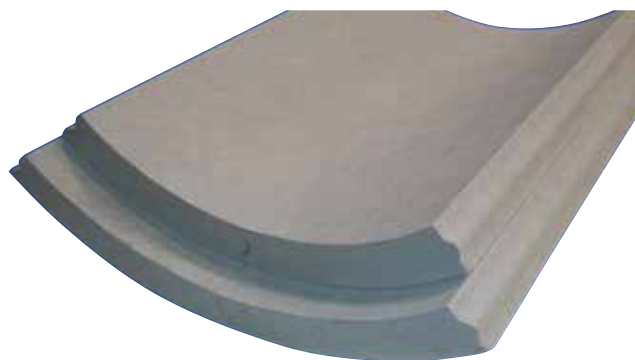
WDS UltraShell insulation offers the low thermal conductivity needed in hot piping applications to ensure that materials inside are insulated from ambient conditions, in addition to protecting workers from burns due to contact with non-insulated hot piping.

The superior insulating properties of WDS UltraShell insulation ensure that the temperature of the product within the piping remains as constant as possible while minimizing the pipes' outside diameter and thickness. Constructed from fumed silica and other inorganic silicates that act as opacifiers for minimizing infrared radiation, the core material of the WDS Ultra is not flammable and meets the requirements of ASTM E84 with Smoke/Flame Spread rating 0/0 (US) and DIN ISO 4102 for fire protection class A1 (EU).

WDS UltraShell insulation is custom engineered to each

application, and features easy, dust-free handling with no harmful materials. The small dimensions of WDS Ultrashell insulation leads to improved maintenance access and less congested piping systems.

In addition to WDS UltraShell insulation for pipe sections, Morgan also offers WDS FlexiPipe, a slat semi-flexible insulation product and WDS MultiFlex, a 3D flexible stitched panel. Depending upon the application's requirements, the products can often be combined together or used in combination with other insulators, including a water repellent grade of Superwool® Plus™ blanket. When combined, Morgan's products provide superior thermal performances and solve the problem of corrosion under insulation (CUI).



## Richard Clark of Morgan selected to speak on microporous insulation at MS&T 15

SEPTEMBER 2015

Morgan Advanced Materials announces that strategic business development specialist Richard Clark will be presenting "The Unparalleled Advantages of Microporous Insulation" at the upcoming Materials Science and Technology 2015 (MS&T15) conference. His presentation, part of the Thermal Protection Materials and Systems symposium, will take place October 6, 2015 at 3:00 p.m. in the Greater Columbus Convention Center, Room E160A.

Mr. Clark will focus on how microporous insulation materials can facilitate the slim and lightweight construction design that is essential in the aerospace and aircraft industries. The materials are used as part of engine insulation in civilian aircraft, as well as in rocket engines, flight data recorders ("black boxes"), and other exhaust systems, as well as part of high efficiency fire protection systems. With the correct material, high thermal insulation and low weight characteristics can be achieved at temperatures up to 1100°C.

The talk will share a variety of application examples illustrating why microporous insulation materials' excellent thermal characteristics and design flexibility make them an ideal choice for protecting sensitive measuring instruments. Examples include the

NetLander designed for the ESA Mars expedition, which provided the legacy for MetNet and other planetary probe missions. While focusing on extreme applications, Mr. Clark will also examine how microporous insulation material and design considerations facilitate improvements in other energy-related applications.



# New sensors deliver unrivalled accuracy in oil & gas applications

SEPTEMBER 2015

Morgan Advanced Materials has launched a new range of high-accuracy sensors for the oil & gas extraction sector, harnessing the unique capabilities of its proprietary piezoelectric materials which can provide reliable sensing and monitoring in high-temperature environments above 200°C.

Suitable for applications from custody transfer to gas flow monitoring, the sensors from Morgan's Technical Ceramics business draw on the proven properties of lead zirconate titanate (PZT).

With a compact footprint and boasting the extremely high sensitivity required – especially in natural gas applications - the sensors are capable of measuring both high and low flow to extreme accuracies.

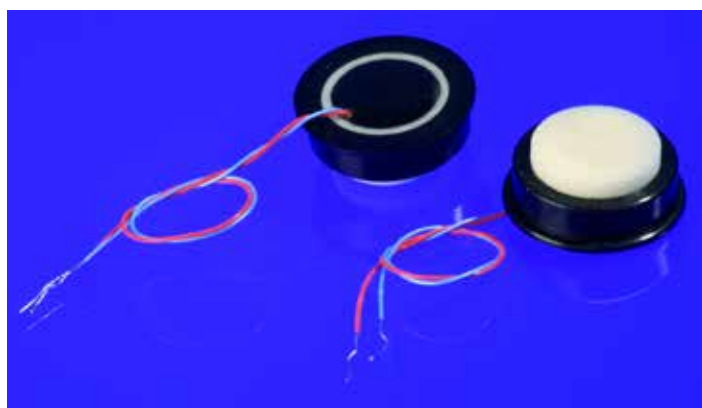
Their ultrasonic nature also means they cope better with potential pressure drop than alternatives, such as turbine meters and electromagnetic meters.

Made from a selection of inert materials including titanium, alumina and zirconia, the new Morgan sensors also boast enhanced corrosion resistance when compared with conventional alternatives. This is particularly useful in harsh environments.

Charles Dowling of Morgan Advanced Materials explained: "Accurate sensing is key in the oil & gas sector for cost,

environmental and safety reasons, but the high-temperature and highly corrosive environments experienced present a unique set of challenges for sensors.

"Some other ultrasonic sensors struggle to maintain accurate operation at temperatures above 200°C – however, our piezoelectric materials have been proven to withstand continuous use at up to 250°C with an intermittent maximum of 300°C, providing peace of mind for specifiers seeking a reliable, accurate solution. When their compact size and conductivity are also taken into account, they represent an attractive option for both custody transfer and flaring applications."



# Morgan and Tyr Tactical personal protection armour systems pass NIJ Level III certification

SEPTEMBER 2015

Morgan Advanced Materials has announced that its revolutionary hard armour plate, in conjunction with Tyr Tactical's soft armour system, has successfully passed the ballistic, durability, and environmental requirements of the highly exacting NIJ 0101.06 Level III certification process. Full NIJ certification is pending, with completion expected this year.

Drawing on Morgan's experience in soldier protection systems, which combine ultra-light weight with optimised protection, the latest hard armour is so light that it is buoyant. With a 254mm x 305mm plate weighing 980g and just over 20mm thick, the modular, scalable system provides substantial weight and thickness advantages - 35 per cent and 25 per cent respectively when compared with typical stand-alone plates.

The system consists of a Lightweight Buoyant LWBIII+ rifle plate, developed by Morgan's Composites & Defence Systems business, with Tyr Tactical's T52/SP or T54/C soft armour. In addition to the NIJ Level III threat, the Level III+ system is capable of stopping a variety of rifle threats, including 7.62mm ball rounds, 7.62mm mild steel core (AK47)

rounds and 5.56mm ball rounds (M193 and LE223T3). The ultra-lightweight, high-performance hard plate insert, manufactured from the latest generation durable composite technology, is extremely hard-wearing and designed specifically for the rugged environments faced by military and security personnel. The products are available to law enforcement, security, and military/defence customers.

Morgan's Duncan Eldridge explained: "The NIJ 0101.06 Level III certification process tests armour products to their absolute limits and guarantees performance in the most demanding operational scenarios. The buoyancy of our hard armour systems offers an extra dimension alongside the proven armour which delivers optimised protective performance at the lowest possible weight – a vital attribute in the field where soldier, marine or coastguard mobility and fatigue reduction are key factors in specification." The rifle plates, soft armour, and full system are available through Morgan Advanced Materials and its network of local agents.

# Morgan Advanced Materials highlights WDS® Flexible Pipe solution, ideal for deep-sea pipelines

SEPTEMBER 2015

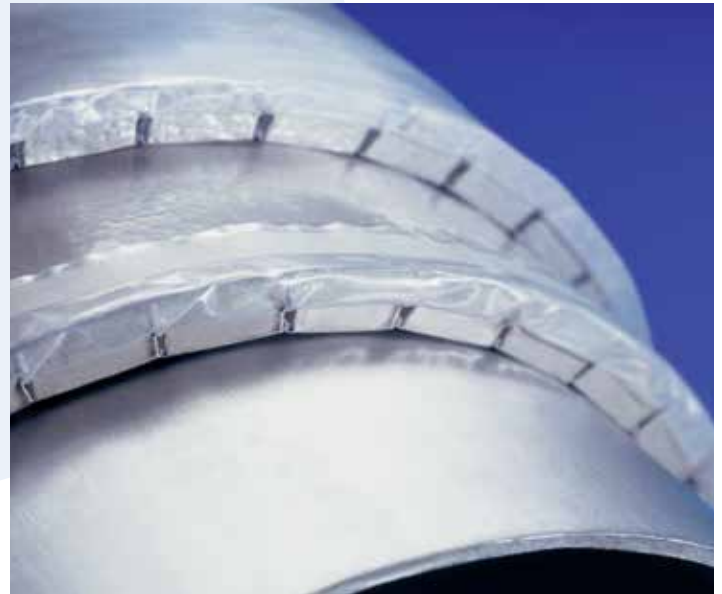
The Thermal Ceramics business of Morgan Advanced Materials announces the availability of its WDS® Flexible Pipe microporous insulation, ideal for deep-sea oil pipelines due its flexibility and superior insulating properties. Morgan's Porextherm® WDS Flexible Pipe solution enables the construction of smaller, lighter, and more cost-effective double-wall offshore pipelines ("pipe in pipe" systems).

WDS Flexible Pipe offers the flexibility needed in underwater pipelines due to the extreme forces at play deep under the ocean surface. In addition, temperature and insulation is of great concern in underwater pipelines, since the oil exiting a deep-sea well tends to be far higher in temperature than the surrounding water, at depths of up to 6900 feet (2103 meters). As a result, improperly insulated pipes can lead to oil with increased viscosity, with decreased flow rates and increased paraffin buildup.

The superior insulating properties of WDS Flexible Pipe ensures that the temperature of the oil remains as constant as possible, thereby resulting in undisturbed oil retrieval while minimizing the outside diameter and thickness of the "pipe in pipe" pipelines. Through a slitting feature, the panels can be easily fitted around pipes. For an easier and cleaner handling, WDS Flexible Pipe is supplied in a polyamide/polyethylene laminated

film system under a light vacuum.

The WDS Flexible Pipe product is tailored to individual customers' applications, and offers easy, dust-free handling with no harmful materials.



# Morgan announces Min-K® microporous insulation with exceptional thermal management performance

SEPTEMBER 2015

Morgan Advanced Materials announces the availability of Min-K® microporous insulation, which delivers high performance thermal management for the most demanding rail applications including data recorder, thermal barrier, and fire protection applications for passenger and cargo rail systems. Featuring low thermal conductivity, high compressive strength and low weight, Min-K is available in flexible, board and shape, and tape forms.

Morgan originally developed its patented Min-K 1303 endothermic microporous insulation material for crash hardened memory modules and event recorders. Min-K contains a raw material that absorbs a portion of the energy from a fire or sudden temperature rise, thereby delaying heat transfer to the inside. This endothermic effect, in combination with the properties of Min-K microporous insulation, provides superior insulation as part of an overall system. The endothermic microporous material is typically pressed or molded and then machined to close dimensional tolerances, to provide a crash worthy housing for the event recorder.

For applications that require a material that can cycle between

high and low temperatures, Min-K 2000 offers low thermal conductivity insulation that can be molded and/or machined to shape. This material is a good choice for use in data recorders and to produce tight tolerance board insulation.

Also available is Flexible Min-K, a composite system consisting of a microporous core encapsulated between layers of high temperature cloth and quilted in 1-inch (2.5 cm) squares. The quilting maintains core distribution in high vibration environments and allows the insulation to be wrapped or bent to conform to unique geometric shapes during installation.

Min-K composite, a combination of flexible Min-K microporous insulation with K-Shield® FeltAG or K-Shield® BF Paper, offers the low thermal conductivity of microporous insulation with the high temperature-use limit of ceramic fiber felts and papers, resulting in a lighter weight, lower cost product with improved flexibility and good sound absorption at different frequencies. Min-K® microporous insulation is a good option for hard-to-insulate areas, where weight is critical and working space is minimal.

## ABOUT MORGAN ADVANCED MATERIALS



Morgan Advanced Materials is a global engineering company offering world-leading competencies in materials science, specialist manufacturing and applications engineering.

We focus our resources on the delivery of products that help our customers to solve technically challenging Problems, enabling them to address global trends such as energy demand, advances in healthcare and environmental sustainability.

### What differentiates us?

Advanced material science and processing capabilities. Extensive applications engineering experience. A strong history of innovation and reinvention. Consistent and reliable performance. A truly global footprint. We find and invest in the best people.

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