

Introducing the new Air In Line Sensor

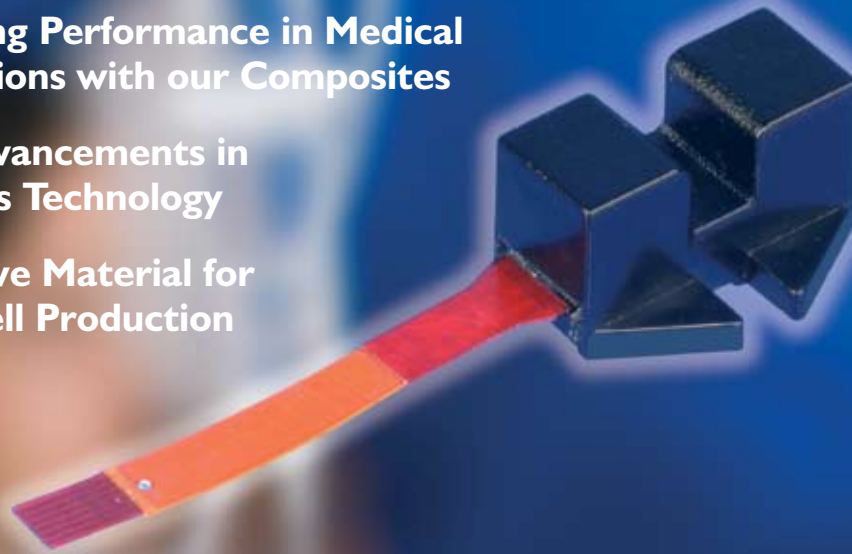
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Fused Silica Rollers Move into Solar

Increasing Performance in Medical Applications with our Composites

New Advancements in Materials Technology

Innovative Material for TFPV Cell Production



Inspiring Processing Techniques Increase Performance of Sonar

Manufacturing Processes Extend Reliability of Drill Bits for Fossil Fuel Exploration

Another ISO Award for Our Medical Implant Business

Offering Significant Improvements over Traditional Transducer Materials

New Material Improves Patient Comfort and Quality of Life

NEWS RELEASE

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It is very important that as a business we take control of the things that are within our power rather than rely on a global economic recovery

I am very pleased by the division's results for the first half of 2009, which show the greatly improved resilience of our business to a very difficult market environment. I would like to thank all our employees for their continued hard work and commitment during what has been a particularly testing time.

There have been some very difficult decisions to make this year; however, I remain confident that we are taking the right actions to support the future of the business. So whilst we have had to control costs and reduce headcount in some areas, we have also been able to strengthen our skill base with continued training and recruitment of key personnel. We can also take some credit that our strategy has proved to be worthwhile. Focussing on growth markets, away from more economically cyclical sectors, where we have developed distinctive competences that add value to our customers has successfully mitigated the worst effects of a very significant downturn in global industrial demand.

Total revenues for the first half of 2009 were £110.6 million (2008: £98.3 million) an increase of 12.5%. This included £26.0 million (2008: £14.4 million) of revenue contributed by the businesses acquired from Carpenter in 2008. At constant currency, organic revenue in Technical Ceramics, excluding the Carpenter businesses declined by 15.7%.

Divisional EBITA was £12.3 million (2008: £14.0 million), a decrease of 12.1%. This included £3.5 million (2008: £2.4 million) of EBITA from the acquired Carpenter businesses. EBITA margins in the main Technical Ceramics businesses were 10.4% (2008: 13.8%), and in the acquired Carpenter businesses 13.5% (2008: 16.7%), resulting in an overall divisional EBITA margin for the first half of 11.1% (2008: 14.2%).

Demand has clearly been impacted by the overall economic environment although there were some end-markets which

have continued to show resilience. In the US, during the first half, demand held up well for Industrial Gas Turbine applications in our Certech business and for our advanced medical components. Aerospace markets started the year well but weakened during the second quarter as customers destocked. Consumer electronic customers also saw a period of destocking in the supply chain which now appears to be stabilising.

Our European and Asian regions had a challenging first half with weak market conditions in general industrial and construction markets which affected our thermal processing business, particularly in Germany. Niche business in Defence and Medical markets was more robust. The small site in Shanghai was successfully closed on time and to plan during the first half of the year.

It is very important that as a business we take control of the things that are within our power rather than rely on a global economic recovery, which may or may not materialise. So in response to the anticipated weaker global market conditions we took early and decisive action on our cost base to align capacity with market demand and to protect our margins. These measures will deliver progressively greater benefits in the second half of the year without detriment to our ability to respond to better market conditions as and when the macroeconomic climate improves.

Looking ahead to the second half of 2009, we will be continuing to maintain a very rigorous focus on cash generation and balance sheet management. As a result of the work done in the first half we converted most of our profit into cash helping the group reduce its net debt position. This is important, as generating cash allows us to invest in new business opportunities whether they are organic or acquisition related.

Once again my sincere thanks to all our staff for all their hard work and dedication and to our customers for their business.

Andrew Hosty CEO

Accurate bubble detection with our new Air In Line Sensors

Morgan Technical Ceramics Electroceramics (MTC Electroceramics) has launched a new Air In Line sensor for use in medical devices that deliver fluids to patients' circulatory systems. The ultrasonic sensors give reliable and accurate detection of the presence of air bubbles in fluids, providing OEMs with a key safety element for equipment, such as infusion pumps.



Accurate detection of air bubbles is vital in maintaining the health and recovery of patients. Air embolisms can lead to serious complications in blood flow and the new sensors prevent excessive amounts of air from reaching the patient's blood. The sensors are suitable for use with many medical devices including infusion pumps, enteral feeding pumps and dialysis equipment.

The sensors, which are based on proven ultrasonic piezoceramic technology, are suitable for use with a four millimetre PVC or Silicon tubing and can be mounted in any orientation. They are capable of detecting air bubbles of down to one millimetre in diameter (0.5uL). Each one operates with a nominal resonant frequency of 1.45MHz and is capable of a receive sensitivity of 30dB down from the drive. The sensors can be supplied individually, or as part of a custom designed system.

"Our customised manufacturing capability enables us to provide bespoke solutions – from the bare tuned piezoceramic disc or plate to a fully functional packaged sensor, with optional additional features such as flow stop mechanisms, optical sensors for the tube and mechanism location detection, and pressure sensors to detect occlusions," says Tony Beswick, General Manager, MTC Electroceramics Southampton.

Resistance to wear and its inherent stability make ceramic an ideal material for a wide range of medical applications from implants to surgical tools. MTC Electroceramics works with many leading medical device manufacturers, providing them with technical expertise and ceramic components for applications including ultrasonic imaging, surgical cutting and bone growth simulation.

Rolling into Solar applications

Our rollers have excellent mechanical properties for the Solar industry

Morgan Technical Ceramics (MTC) is now offering Fused Silica rollers for use in solar energy applications from its Bolt Technical Ceramics business located in Fairfield, New Jersey. The Fused Silica rollers are manufactured under the Haldenwanger brand name in MTC's facilities in Yixing, China and Waldkraiburg, Germany. The outstanding mechanical properties and special surface quality of the Fused Silica rollers make them ideal for use in both diffusion and thin film processing of solar panels.

Traditionally used for handling sheet glass for automobiles, appliances and architectural applications, Fused Silica rollers are now being used in the manufacturing of solar cells.

The Fused Silica rollers move hot glass panels through the deposition process used in manufacturing Thin Film Photovoltaic (TFPV) cells. The thermal stability of silica is exceptional; it has a coefficient of thermal expansion (CTE) of $< 1 \times 10^{-6}/^{\circ}\text{C}$ – lower than any other ceramic material. This low CTE combined with its chemical compatibility with glass make Fused Silica rollers an ideal choice for ensuring the glass panels remains flat during the manufacturing process.

The Fused Silica rollers are also used to move Silicon wafers through the acid doping process where corrosive acid and high temperatures are required. The thin Silicon wafers maintain their shape due to the low coefficient of thermal expansion and chemical resistance of the Fused Silica rollers.

Use of the Fused Silica rollers in the TFPV and diffusion manufacturing process is an important innovation that makes the goal of using solar energy to generate more of the world's electricity more attainable.

The rollers are available in a wide variety of standard dimensions, with outer diameters ranging from 15 to 110 millimeters (mm), and in lengths ranging from 305 to 4100 mm. Custom designs and dimensions are also offered.



Applause for our new composite components which increase acoustic performance

Our new Piezoelectric composite material is ideal for use in medical applications

Morgan Technical Ceramics Electroceramics (MTC Electroceramics) introduces its Piezoelectric composite components, which dramatically improves the performance of ultrasound transducers used in medical applications, including sensors for catheters, blood pressure, auditory sounds, vascular flow, and medical imaging. Components manufactured with Piezocomposite materials offer significant improvements over traditional transducer materials, which result in increased acoustic performance.

MTC Electroceramics' Piezoelectric composite material, consisting of a ferroelectric ceramic in an electrically-inactive polymer matrix, is specifically formulated with high coupling values and high dielectric properties, and is well suited for thin and small parts. Combining the Piezoelectric

ceramic with polymer filler means that the overall density of the material better matches the medium through which the sound waves travel. This results in lower acoustic impedance, higher energy transfer through body tissue, and a lower reverberation level on the front face of the acoustic device.

The material reduces the cross coupling that can occur between different modes in the ceramic of conventional transducers, enabling medical components to respond more precisely and predictably. Components manufactured with MTC Electroceramics' Piezoelectric composite materials reduce spurious activity, offering higher transmit and receive efficiency. They also provide lower acoustic impedance and improved transducer bandwidth compared to those made of conventional piezoelectric ceramics alone.

MTC Electroceramics offers Piezoelectric composites in 1-3 and 2-2 structures, in sizes up to 1.5" square and frequencies from 100 kHz to 12 MHz. Piezoelectric volume fractions can be tailored for any application to enhance transmit and receive response rates.

The Piezocomposites provide increased design flexibility because they can be thermoformed to conform to curved, complex geometric surfaces to which conventional piezoceramic materials often cannot be shaped. MTC Electroceramics offers Piezoelectric composites in both standard and custom materials, including types I, II, and VI, as well as Single Crystal Lead Magnesium Niobate-Lead Titanate (PMN-PT).

New innovations in materials technology

Our new P52 core material improves core stability in jet engine applications

Morgan Technical Ceramics Certech (MTC Certech), a leader in the investment casting industry, has introduced its advanced P52 core material used for producing ceramic cores that remain extremely stable with the high temperature super alloys now being used to

cast quieter and more fuel-efficient jet engines. The Fused Silica ceramic cores are ideal in airfoil casting of blades and vanes for rotating and static parts of these engines.

To attain greater fuel efficiencies, engines are running at increasingly higher temperatures and must be cooled with more intricate cooling schemes, requiring the casting of complex cooling passages. Stronger metal alloys are also being used in the casting process and a core material must be able to withstand the extremely high temperatures used to pour them. MTC Certech's core material is able to achieve this.

The P52 core material stays rigid, maintaining extremely tight, consistent wall tolerances. Large volumes of dimensionally accurate parts can be produced on a timely basis. Holding thinner metal walls more accurately results in higher casting yields, reduced scrap rates and lower casting costs.

Another advantage of the P52 core's stability is that manufacturers can reduce or eliminate the use of costly platinum pins to hold the ceramic in place and support the core during the casting process. This results in additional cost savings.

While dimensionally strong, P52 core material also exhibits improved crushability during solidification. This means that it remains rigid and stable through the cooling process but is crushable when it needs to be during the metal solidification process. This is particularly useful for alloys that are prone to hot-tearing (as found in Equiax castings) or re-crystallization (castings that are involved in directionally solidified or Single Crystal Castings).



Our material takes the heat in the production of TFPV cells for Solar

Performance[®] Pyrolytic Boron Nitride (PBN) material ideal for use in Thin Film Photovoltaic Deposition process

Morgan Technical Ceramics' CVD Materials (MTC CVD Materials) offers its Performance[®] Pyrolytic Boron Nitride (PBN) material for use in manufacturing of the photo absorption layer in Thin Film Photovoltaic (TFPV) cells. Performance PBN is an excellent material for crucibles and evaporation boats used in producing the TFPV cells, as well as for coating graphite heating elements used for material vaporisation.

In solar cell production, Thin Film Deposition offers a simpler and more cost effective alternative to using Silicon wafers. Thin films use less material and are much faster and simpler than the complex and delicate process of slicing, dicing and placing of Silicon wafers. However the cost of deposition must be reduced and the efficiency of the resulting PV cells sufficiently increased to make solar electricity as inexpensive to generate as carbon-based methods. Use of the PBN material in the TFPV process is considered an important innovation that will make the goal of using solar energy to generate more of the world's electricity more attainable. MTC CVD Materials is working with leading players in PV cell manufacture in the USA, Europe and Asia, supplying a wide variety of components for thin film solar cells.

In the TFPV deposition process, precursor vapors are transported from a source vessel into a deposition zone onto a heated substrate to deposit the PV layer. In some instances, solid materials are melted and vaporised from ceramic crucibles or boats to form a flux that is deposited

on the heated substrate. It is critical that the ceramic crucible or boat be dimensionally stable and chemically non-reactive to the molten source material. PBN ceramic is an excellent material because of its high corrosion resistance and non-reactivity with the source materials used in PV deposition.

The PBN material is highly anisotropic (directionally dependent) in its thermal transport and very resistant to thermal shock. PBN is also an excellent electrical insulator. The material is stable in inert and reducing atmospheres up to 2800°C and in oxidizing atmospheres to 850°C.



Developing new ways to process ceramic plates for the advancement of Sonar

Morgan Technical Ceramics Electroceramics (MTC Electroceramics) has developed a new processing technique for manufacturing the ceramic plates used in Piezoelectric composite transducers for sonar equipment.

The result of the new process is a component with consistent material density distribution, which gives reliable operating performance, critical for medical, commercial and defence applications. The new plates enable customers to improve electromechanical coupling and acoustic impedance characteristics of the transducers, leading to a higher resolution of the sonar equipment. As a result the plates can enable the advancement of sonar technologies, such as the new high-resolution 4-D ultrasound scanning technology used in medical imaging.

"Key drivers from our customers are for very consistent properties throughout the plate, and many manufacturers have struggled to deliver this," says Dr Ashley Darby, Business Manager, MTC Electroceramics. "We have successfully refined our manufacturing processes at our site in Ruabon, UK and have worked closely with our customers to develop a cost-effective component that meets their needs."

The company now has the capability to manufacture ceramic plates up to 30mm thickness, with an even density distribution throughout the plate. These are diced into pillars of widths as small as two millimetres and embedded in a resin mix which is then used by customers to make 1-3 composites. In addition to a more cost effective component the new process

also significantly reduces lead time. Ceramic plates can now be manufactured and delivered within 30 days of ordering.

MTC Electroceramics has provided precision-engineered materials, components and assemblies to the international Defence and Security markets for more than 50 years. Applications range from military hardware to surveillance equipment, such as sub-sea detecting and sensing. The company is also a world leader in the design and manufacture of ceramic implants and complex ceramic assemblies for surgical tools, medical instrumentation, therapeutic and diagnostic equipment with its ceramics favoured by both medical device manufacturers and the medical professions.

Development of a new process to extend the reliability of deep drilling bits used for oil / fossil fuel exploration

Morgan Technical Ceramics Wesgo Metals (MTC Wesgo Metals) business has developed a proprietary manufacturing process for the production of high-strength, high-purity alloys for deep-drilling bits used in oil and fossil fuel exploration. The superior performance alloys made using this new process significantly improve the reliability of the drill bits. As a result of the development, mining equipment manufacturers can offer increased tool life thereby reducing maintenance-related costs and increasing productivity for their customers.

Increased reliability is achieved by using stringent process controls during the manufacture of the alloys. These enable a tightly controlled composition to be produced resulting in consistent and reliable braze temperatures during subsequent processing. The alloy is ideal for brazing Polycrystalline Diamond Cutters (PDC) to Tungsten.

"The significant growth in deep drilling and fossil fuel markets has led to an increase in demand for our specialised brazing alloys" explains Mark Miklos, General Manager, MTC Wesgo Metals. "We have been able to meet that demand through this new process and can now offer customers reduced lead times and increased capacity in addition to being able to provide custom preforms according to their specification."



Further ISO award for our medical implant business

ISO 13485: 2003 Certification Attained for Medical Implants

Adoption of ISO Standard will help the company further “raise the bar” on producing high quality components for medical devices

Morgan Technical Ceramics' Alberox business (MTC Alberox) has attained ISO 13485:2003 certification. ISO 13485:2003 represents the requirements for a comprehensive quality management system for the manufacture of medical devices. In order to achieve this certification, companies must demonstrate the ability to provide products and services that consistently meet customer and regulatory requirements.

The certification applies to the company's Medical Implant Business Unit and its internally supplied Ceramics Department. With MTC Alberox's strong technical background in applications engineering and tight process controls, this

certification will enable the company to “raise the bar” in producing high quality critical components for the company's extensive medical customer base.

The entire Medical Implant Business Unit will be encapsulated in a class 100,000 cleanroom. This will enable MTC Alberox to effectively implement and maintain Good Manufacturing Processes (GMP) throughout the facility. The ISO 13485:2003 standard supersedes earlier documents such as EN 46001 and EN 46002 (both 1997), the ISO 13485 published in 1996 and ISO 13488 (also 1996). While it remains a stand-alone document, ISO 13485:2003 is generally harmonised with ISO 9001.

A fundamental difference, however, is that ISO 9001 requires the organization to demonstrate continuous improvement, whereas ISO 13485:2003 only requires the company to demonstrate that the quality system is implemented and maintained.

"This new ISO certification is a significant milestone in the advancement of our medical device business," said Ken Camara, MTC Alberox Sales Manager. "More importantly, by acquiring this designation, our customers can be even more confident that our manufacturing practices adhere to the highest possible standards, and that they will be purchasing the highest-quality critical medical component products available."

Sonar applications significantly improved by our piezoelectric composite material

Morgan Technical Ceramics Electroceramics (MTC Electroceramics) introduces its piezoelectric composite components for use in increasing the acoustic performance of military and commercial sonar receiver applications. Components manufactured with MTC Electroceramics' piezocomposite materials offer significant improvements over traditional transducer materials.

MTC Electroceramics' Piezoelectric composite material, consisting of a ferroelectric ceramic in an electrically-inactive polymer matrix, is specifically formulated with high coupling values and high dielectric properties. Combining the Piezoelectric ceramic with polymer filler results in a material with an overall density that better matches the medium through which the sound waves travel. This leads to lower acoustic impedance, higher energy transfer through water, and a lower reverberation level on the front face of the acoustic device.

The materials reduce the cross coupling that typically occurs between different modes in the ceramic of conventional transducers, enabling sonar components to respond more precisely and predictably. In addition, components manufactured with MTC Electroceramics' Piezoelectric composite materials reduce spurious activity, offering higher transmit and receive efficiency. They also provide lower acoustic impedance and improved transducer bandwidth compared to those made only of conventional Piezoelectric ceramics.

MTC Electroceramics offers Piezoelectric composites in 1-3 and 2-2 architectures, in sizes up to 1.5" square and frequencies from 100 kHz to 12 MHz. Piezoelectric volume fractions can be tailored for any application to enhance transmit and receive response rates.

The Piezoelectric composites offer increased design flexibility, because they can be thermoformed to conform to curved, complex

geometric surfaces to which conventional piezoceramic materials often cannot be shaped. MTC Electroceramics offers Piezoelectric composites in both standard and custom materials, including types I, II, VI and Single Crystal Lead Magnesium Niobate-Lead Titanate.

Improving patient comfort and quality of life with our new material

Morgan Technical Ceramics (MTC) has developed a new bioceramic material for surgical implant devices. Vitox® AMC is an Alumina matrix composite material which can withstand high shock without fracture and exhibits exceptionally low wear rates compared to Alumina, Metal or Polyethylene alternatives. As a result it is ideal for less invasive surgeries, thereby reducing patient trauma and improving post operation recovery time.

"Ceramic has had a long and successful history of use in implantable medical devices," explains Yannick Galais, Commercial Manager, at MTC, a company that has supplied the medical industry with ceramic components for more than 24 years. "Our aim was to find a way to combine high wear resistance, excellent mechanical properties and long term stability into a single bioceramic that would improve comfort and quality of life for patients."

Vitox® AMC, developed at the company's facility in Rugby, UK, is a high purity, sub-micron grain sized Alumina matrix composite offering a 55% increase in 4-point flexural strength and a 12.5% increase in fracture toughness compared to high purity implantable grade Alumina. The company's material specialists have formulated the composite to enhance the mechanical properties of Alumina.

The material's high strength and mechanical properties enable intricate shapes to be manufactured and prosthesis with thinner wall sections to be produced. It enables the manufacture of larger diameter femoral heads (up to approximately 60mm diameter) and thin wall section acetabular cups. Both are proven to reduce the likelihood of dislocation by providing a more stable joint, a problem in patients who have undergone total hip replacement arthroplasty surgery. Larger bioceramic hip joints, close in diameter to natural bone sizes, give recipients a wider range of motion without the potential for dislocation, improving quality of life.

Vitox® AMC could also be used in a new form of arthroplasty which has been developed for bone preservation. The new material can be used in products that are designed for minimally invasive procedures and easier revision surgeries, which prolong the need for total hip replacement.

Vitox® AMC can be used in ceramic-on-ceramic systems or in conjunction with a Polyethylene and metal acetabular cup in hip replacements.