

## Morgan Advanced Ceramics To Showcase Metal Injection Molding Technology at MD&M East

The Alberox Products Division of Morgan Advanced Ceramics (MAC), will showcase its Metal Injection Molding (MIM) technology at booth # 2005 at MD&M East at the Jacob K. Javits Convention Center in New York from June 13-15, 2005. MIM is suited for a variety of medical applications including surgical instruments, laparoscopic cutting tips, biopsy jaws and dental brackets.



Located in New Bedford, Massachusetts, MAC's Alberox Products Division will be exhibiting in conjunction with The SouthCoast Development Partnership, a regional, business-led collaborative, which promotes economic opportunities for the SouthCoast region of Massachusetts.

MIM is the process in which a fine metal powder, typically in the sub 20µm range, is mixed with a proprietary binder system to create a feedstock. It is a cost effective method of producing small, complex, metal components in high volume (typically >10,000) that are difficult-to-machine using conventional methods. An alternative to traditional machining and casting processes, MIM produces net shape parts with little or no secondary machining.

Similar to plastic injection molding, the feedstock is heated into a slurry and injected into the mold, in this way the MIM process is differentiated from the Press and Sintered (P&S) process. Unlike P&S, MIM can achieve cored sections and side thro-holes without secondary machining. MIM achieves uniform densities in the range of 98+% , whereas P&S only reaches densities of 85%.

Ideal materials for the MIM process include: 17-4 PH Stainless Steel, 304L Stainless Steel, 316L Stainless Steel, Kovar, Tungsten Heavy Metal, Copper, and Copper-Molybdenum. Other materials and custom alloys can also be produced.

MAY 2005

## Morgan Electro Ceramics Showcases Doppler System Flow Sensor With Minimum Cross Talk At ISA Expo 2005

Morgan Electro Ceramics (MEC), showcases its proprietary new Doppler System sensor at ISA Expo 2005. The sensor utilizes a semi-circular send and receive piezoelectric ceramic (PZT) crystals within a circular compact stainless steel housing. This single enclosure eliminates the need for separate send and receive sensors and provides a sensitive, simple

and low-cost solution for fluid flow sensor applications. Learn more about MEC and the Doppler System sensor at booth # 1460 at ISA Expo 2005 at the McCormick Place Lakeside Center in Chicago, Illinois from October 25-27, 2005.

This innovative solution is accomplished through the use of semi-circular PZT crystals, which maximize the radiating surface area in the circular housing, and by optimizing "¼ -wave" and "shear wave mode change" principles to minimize crosstalk. Preliminary tests indicate -65 dB's of crosstalk. The sensor is available to accommodate the customer's operating frequency, sealing and packaging requirements.

MEC's piezoelectric ceramics allow for the conversion pressure and vibration into electrical energy, making it ideal for accelerometers, sensors, flowmeters, level detectors and hydrophones.

JUNE 2005

## Morgan Advanced Ceramics Showcases Its High Reflectivity Ceramic Reflectors For Intense Pulse Light (TM) Systems At CLEO 2005

Morgan Advanced Ceramics (MAC), will showcase its ceramic reflectors for Intense Pulse Light™ (IPL) systems at booth # 1351 at the Conference on Lasers and Electro-Optics (CLEO) 2005, held at the Baltimore Convention Center in Baltimore, Maryland on May 24-26, 2005. MAC's ceramic reflectors are manufactured with Sintox AL, a high purity (99.7% AL2O3) material, and are ideally suited for a variety of solid-state laser applications and IPL systems used for skin treatment and hair removal. IPL is a fast growing market due to the systems' low cost, flexibility, and user-friendly process.

MAC's ceramic reflectors offer high strength, resistance to chemical attack, high reflectivity over a broad wavelength band, good thermal conductivity, and excellent dimensional and electrical stability at all operating temperatures. IPL systems use Xenon flashlamps, a gas discharge lamp that produces extremely intense, full-spectrum white light for a short duration. MAC's ceramic reflectors form a cavity that house the lamp and focuses this white light for faster, more efficient patient treatment.



The use of MAC's Sintox AL ceramic reflectors allows IPL systems to be cost-effective options for a range of cosmetic treatments. MAC's Sintox AL has reflectance properties in excess of 96% (typically 97-98.7%) over the 500 nm to 2000 nm wavelengths, and provides highly diffuse reflectance by reflecting and refracting light back into the cavity.

MARCH 2005

## Morgan Advanced Ceramics Extends The Benefits Of Its Ceramic Materials To Specialized Medical Applications

Morgan Advanced Ceramics (MAC) extends the benefits of its ceramic materials to a wide range of medical applications, including joint replacement surgery. MAC's bioceramics offer superior wear resistance and inherent biocompatibility, resulting in superior implant longevity when compared to alternative material bearing couples. Offering medical professionals and patients new options in orthopedics, MAC's ceramics generate less polyethylene debris when used with polyethylene acetabular components. In fact, MAC's ceramic on ceramic technology totally eliminates polyethylene debris that induces osteolysis, the primary cause of costly revision operations. The use of HIP Vitox® alumina and Zyranox® zirconia also eliminate the problematic side effects of metal ion release.

MAC offers both HIP Vitox® alumina and Zyranox® zirconia for the manufacture of surgical implant devices, including a range of standard femoral heads and standard ceramic-on-ceramic femoral and acetabular components. In addition, HIP Vitox® alumina is used in the development of custom specific hip replacement devices for advanced surgical procedures. With over 20 years of experience in the development of ceramic joints, MAC's unique and flexible manufacturing process for hip joint prostheses is well suited for the development of next generation ceramic devices, including various endoprosthesis devices for joint replacement of the hand, elbow and shoulder. In addition, MAC's bioceramics are also used in cutting-edge spinal surgical procedures.

JANUARY 2005



## Morgan Electro Ceramics' Advanced Dicing Capability Achieves Fine Cuts And Control

### Newly Developed Dielectric Materials Used to Produce Small, Complex Parts

Morgan Electro Ceramics (MEC) has developed several new piezoelectric materials including single crystal PMN-PT, which when processed with recently introduced advanced dicing capabilities, allow them to offer finely toleranced, small, complex parts. Used in medical, computer, aerospace, industrial and consumer markets, MEC's dicing capability is suited for various applications, including: implantable sensors for wound healing; catheters for imaging and blood clot ablation; accelerometers for the medical, aerospace and automation industries; secondary actuation for disk drive



suspensions; miniature actuators; and air line sensors.

Using highly accurate saws with fully programmable x, y, and z controls, and a supporting vision system, MEC achieves fine cuts and control. MEC supplies piezoelectric materials that are 0.003" (0.076mm) thick and higher, in sizes as small as 0.020" (0.5mm) square for small, intricate components. MEC's miniature, multi-layered piezoelectrics are diced and used in atomic microscopes, ink jet printing, laser path length control, and nano-positioning of fiber optic applications.

Dicing is conducted in a conventional factory setting or in a clean room environment when required. Parts can be supplied in conventional packaging or on a tape frame, allowing customers to select and place small parts using automated equipment.



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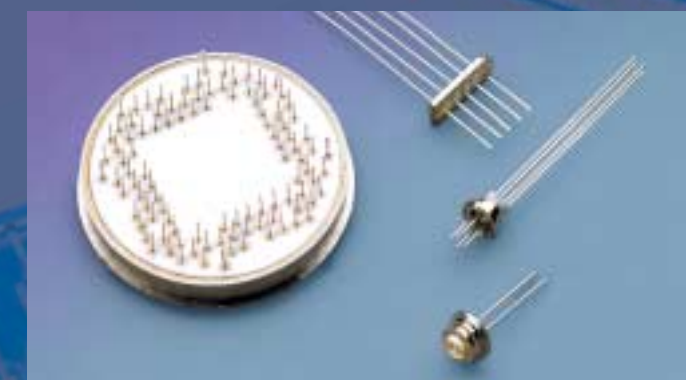


# NEWS RELEASES

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JANUARY - JUNE 2005

## First 104-Pin Feed-thru On Show At MEDTEC China 13-15 September 2005



Morgan Technical Ceramics, industry leading manufacturer of engineered ceramic components for the medical industry, will be displaying its new 104-pin feed-thru at MEDTEC China. The ceramic feed-thru, which is used in drug delivery applications, is the first to house 104 pins within a one-inch diameter. Voltages pass through each pin activating different combinations of switches and as a result medical staff can now control a greater number or more complex collection of drugs at any given time.

To minimise the risk of leakage pure gold is brazed between the Alumina ceramic and pins forming a secure hermetic seal. To minimise the overall size of the device the ceramic is machined, with excellent repeatability, to a thickness of only 0.045 inches. The ceramic is robust and can withstand thermal shock cycles of +200°C to -65°C.

Morgan Technical Ceramics has been working with medical OEMs for over 20 years in developing a range of different sized biocompatible feed-thrus that suit various applications such as implantable pacemakers, defibrillators, and cochlear implants.

Also on display will be the company's ceramic components and ultrasonic sensors used in instrumentation, surgical tools, blood handling and orthopaedics. For further information and a demonstration of these products visit stand 603, MEDTEC China or phone 001 800 433 0638, or email ussales@morganadvancedceramics.com

JUNE 2005

## Wesgo Metals Division Of Morgan Advanced Ceramics Offers Pre-Sintered Preforms For Industrial Gas Turbine Engines

### Low porosity eliminates braze repair shrinkage

The Wesgo Metals Division of Morgan Advanced Ceramics offers a pre-sintered preform (PSP) for the gas turbine industry. These multi-component systems are designed for both dimensional restorations and crack repairs, making them ideal for use in industrial gas turbine engines. Unlike traditional brazing pastes and green tapes the porosity of PSP is less than 5 percent, which helps to eliminate shrinkage. Not only are Wesgo Metals' PSPs easy to handle, they also have an unlimited shelf-life compared to pastes and tapes, therefore providing a cost-effective braze repair solution.

Brazed parts require minimal grinding to restore components to their original dimensions. Additionally, brazing allows whole components to be heated in a vacuum furnace, which results in fewer distortions, increased consistency, and a high-quality repair process. To further decrease milling on graded geometries, Wesgo Metals' PSPs can be manufactured in tapered preforms.

For customized applications, Wesgo Metals offers PSPs in various shapes, including curved, tapered and cylindrical, with thickness ranging from 0.010" (0.3mm) to 0.200" (5mm). Unlike flat preforms, curved PSPs reduce processing time by eliminating the need for a second braze cycle on both convex and concave surfaces. For dimensionally restoring holes and bores, cylindrical preforms are ideal because they will not sag or overflow during brazing.

MAY 2005



Engineered Components to enhance your life...

## Morgan Electro Ceramics Introduces Its Piezoelectric Multi-Layer Actuators



### Ideally Suited for the Positioning of Mirrors in the Laser and Optical Industry

Morgan Electro Ceramics (MEC), a leading manufacturer of electro ceramic products, including high voltage and RF capacitors and microwave and piezoelectric ceramics introduces its piezoelectric multi-layer actuators. With over 50 years of experience in the development and production of electro ceramic materials and components for the electronics industry, MEC offers a wide range of high efficiency, low voltage, multi-layer actuators for a variety of applications, including the positioning of mirrors in the laser and optical industry.

Meeting the industry demand for precise, controllable and repeatable displacement devices in the micrometer and sub-micrometer range, MEC's piezoelectric multi-layer actuators are capable of microns of expansion, kilonewtons of force and tens of microseconds of response time. MEC's multi-layer manufacturing capability ensures a reduction in component size, yielding a faster response time and higher resonant modes, thereby allowing for higher frequencies of operation.

MEC's multi-layer actuators are comprised of many thin layers and then stacked and co-fired at high temperatures in order to achieve a high electric field from a low voltage. This reduced layer thickness allows for the generation of displacements with a reduction in drive voltages, resulting in safer handling and operating conditions, as well as a simplified circuit design. With an electrical field of <3kV/mm, large displacements per unit volume can be achieved with high reliability. MEC offers layer thickness between 20 mm and 60 mm, as well as design flexibility, in order to suit customers specifications.

MAY 2005

## Morgan Advanced Ceramics Announces The Results Of Cytotoxicity Study Conducted On Diamonex DLC Coating

### Diamonex DLC Coating Proves Biocompatible for Medical Applications

Morgan Advanced Ceramics Diamonex Products division announce the results of an in vitro biocompatibility study conducted by NAMS on Diamonex's Diamond-Like Carbon (DLC) coating. This high performance coating provides excellent chemical resistance, low friction, electrical insulation and biocompatibility, and is well-matched for a variety of medical applications, including catheters, surgical instruments, implantable joints, medical instrumentation and packaging. Under the conditions of the study DLC coating showed no evidence of causing cell lysis or toxicity.

"As a result of its superior hardness, low friction and proven biocompatibility, Diamonex DLC coating has demonstrated its exceptional capacity to provide an ideal solution for a wide range of medical applications, from implants to surgical tools," says sponsor Mark Duchnak, Sales and Business Development Manager at Diamonex Products Division.

APRIL 2005



Based on the International Organization for Standardization 10993: Biological Evaluation of Medical Devices, Part 5: Tests of Cytotoxicity: in vitro Methods, the study was conducted on the test article, DLC Coating on Vitox alumina, Zyranox zirconia, Co/Cr, and medical grade Ti (Ti-6Al-4V), to determine the potential for cytotoxicity. Based on USP criteria, the DLC coating surpassed the test requirements by scoring a grade 0 (no lysis), thereby, performing at the highest level. The reagent control, negative control and the positive control also performed as anticipated.

## Morgan Advanced Ceramics Offers Protective Coatings And Solid Film Lubricants For The Semiconductor Industry

### Excellent Protection In Harsh Chip Manufacturing Process

The Engineered Coatings Division of Morgan Advanced Ceramics (MAC), offers protective coatings and solid film lubricant processes ideally suited for a variety of semiconductor machinery applications, including CMP tools, etch machinery, clean room applications, robotics and wafer handling equipment.

The coatings processed by MAC include Ever-Slik® and Everlube®, as well as coatings from Dupont and Whitford. These protective coatings provide excellent corrosion, abrasion and chemical resistance, thereby improving the overall performance of semiconductor processing equipment. Delivering excellent barrier protection in abrasive and harsh environments, the applied solid film

JUNE 2005

## Morgan Technical Ceramics To Showcase Its Dry-Pressed Alumina Ceramic Components And Dielectric Resonators At IMS 2005

Morgan Technical Ceramics (MTC), comprised of Morgan Advanced Ceramics (MAC) and Morgan Electro Ceramics (MEC), is a leading manufacturer of innovative ceramic, glass, precious metal and piezoelectric and dielectric materials. MTC will be exhibiting at the **2005 International Microwave Symposium (IMS), booth # 1512, June 14-16, 2005** at the Long Beach Convention Center in California. Products to be showcased include miniature dry-pressed ceramic components from GBC Materials, a division of MAC, and dielectric resonators from MEC.

Manufactured in outer dimensions ranging from .020" to 2", GBC Materials' miniature dry-pressed alumina ceramic components provide a cost-effective solution for demanding applications. Designed for miniature electronic devices, small dry-pressed alumina components are ideal for use in telecommunications, appliance and

other electronic applications. For additional cost savings, millions of parts per order can be processed using GBC Materials' unique multi-cavity, high-volume manufacturing process. Produced with high quality raw materials, GBC Materials uses stringent process controls, from milling through spray-drying and powder segregation, to assure reproducibility and uniform press powder.

MEC will feature its advanced electroceramic materials with high Relative Permittivity, high Q and good temperature stability, used for dielectric resonators in various microwave applications. These microwave applications include alarm systems, antennas, base station resonators, combiners, dielectric resonator oscillators, doppler radar systems, down converters, inductors, low noise blocks, microwave filters, mobile telephones and voltage

## Morgan Electro Ceramics provides material expertise for Smiths Aerospace



and I'm delighted to say that this was achieved."

The sensors, which form part of the 60 ultrasonic fuel-level probes found in each fuel system of the Boeing 777 aircraft, include Morgan Electro Ceramics' PZT5A2 piezoceramic material. This robust ceramic was originally developed for industrial applications but the temperature stability of the piezoceramic material makes it ideal for the aerospace environment. Further, Morgan Electro Ceramics' high precision engineering capability ensures consistent and reliable production and functional testing (echo response) to meet the required quality standards for Smiths Aerospace.

Leading manufacturer of electro ceramic material solutions, Morgan Electro Ceramics, has been awarded a manufacturing contract by Smiths Aerospace, the aerospace equipment and systems company. Morgan Electro Ceramics has been supplying Smiths Aerospace with its piezoelectric ceramic sub-assembly for fuel-level sensors since the early 90's but will now also be responsible for the manufacture of the full sensors at its facilities in the UK.

"We have sub-contracted this part of the process to enable us (Smiths Aerospace) to focus on the design and manufacture of fuel systems that we provide for all our customers," explains Martin Kirkham, Manufacturing Systems Manager, Smiths Aerospace. "We chose Morgan Electro Ceramics because of its expertise with the material involved and its process capabilities. We trusted them to take over the process quickly and seamlessly

MAY 2005

controlled oscillators. MEC's dielectric resonators are a low cost alternative to metallic resonant cavities because they can be reduced in size without reducing the performance output. Dielectric resonator materials have Er values in the range of 10-100.



MARCH 2005

## Morgan Advanced Ceramics Announces The Relocation Of Its Bolt Technical Ceramics Division

Morgan Advanced Ceramics (MAC) announces the relocation of its Bolt Technical Ceramics division from Conroe, Texas, to Fairfield, New Jersey. Bolt Technical Ceramics is a distributor for the products manufactured by MAC's Haldenwanger operations in Germany and China. Haldenwanger products are primarily used in the Thermal Processing Industry and include Alumina tubes, Fused silica, Aluminium Silicate and Silicon Carbide Ceramic rollers together with high-performance HalSic (Silicon Carbide) Kiln components and Furniture. The relocation will result in Bolt Technical Ceramics combining with MAC's Wesgo/Duramic Products division. The transfer is scheduled for completion by April 2005.

The materials and products that Bolt Technical Ceramics has traditionally offered will remain unchanged, but the machining expertise of the Wesgo/Duramic Products division will compliment the service that is offered from the new location. The products will continue to be manufactured at the Haldenwanger manufacturing plants.

"We are working hard to make this transition as seamless as possible. We plan to maintain the high level of commitment to our customers throughout the move and in the future. Bolt has always had pride in its customer service and the quality of its products. It is with this same pride that MAC's Wesgo/Duramic facility will continue to serve our customers," said customer service representative, Liz Weiss.

MARCH 2005

## Morgan Advanced Ceramics Launches Two New Products At Semicon Europa 2005

Morgan Advanced Ceramics, industry leading manufacturer of engineered ceramic components for the semiconductor industry will be launching two new products at Semicon Europa 2005. Diamonex Phoenix Conditioner, which is a new generation of pad conditioner used in the chemical mechanical polishing (CMP) process of wafer fabrication, and a new 10" (25cm) linear ion-beam source, will be on show on stand 331, Hall 1.

Diamonex Phoenix Conditioners are created using a chemical vapour deposited (CVD) diamond film that bonds diamond grit to a silicon or ceramic substrate. The result is an all-diamond surface that is inert to the corrosive CMP slurry chemistries, eliminating the chemical interaction experienced with nickel-plated and sintered conditioners. The molecular diamond bond also minimizes loose diamond grit, avoiding wafer scratches. Available in a range of sizes, the new conditioners have an improved planarity which increases the amount of diamond in contact with the pad being conditioned, thereby improving the surface condition.

The company's new 10" (25cm) linear ion-beam source has a surface area three times larger than standard circular sources. This extended surface area over which deposition occurs allows manufacturers to reduce costs and increases product throughput for in-line or large scale products. Manufactured with advanced ceramic components, the linear source provides long-term operation in harsh, chemically reactive, deposition environments.

FEBRUARY 2005

## Materials Specialist Reveals How Laser Manufacturers Can Offer Increased Performance In IPL Lasers



Morgan Advanced Ceramics, the industry-leading manufacturer of ceramic components for the laser industry, will be providing attendees of the LASER 2005 show, with an opportunity to find out how using high purity ceramic in IPL (Intense Pulse Lamp) lasers can increase performance without requiring additional power.

The company's Sintox AL ceramic, which has 99.7% Alumina content can exceed reflectance efficiencies of 96% at wavelengths ranging from 500 - 2000nm and 98.7% at 1000nm. This is possible because Sintox AL is processed in a way that maximises light reflectance from its surface. When used in reflectors, the material enables manufacturers to provide a higher quality beam from the same output power source.

For more information on the work the company has already undertaken with major laser manufacturers to develop IPL systems or to find out more about the range of ceramic components the company manufactures and develops for the laser industry visit Stand B1.523 between 13-16th June.

JUNE 2005

## Morgan Advanced Ceramics' Diamonex Products Division Achieves ISO-14001: 1996

### Better Serving the Environment through Recycling, Waste Reduction, and Health and Safety Initiatives

Morgan Advanced Ceramics (MAC), is pleased to announce that its Diamonex Products division, located in Allentown, PA, has achieved the ISO-14001:1996 International Environmental Management System standards certification from the British Standards Institution (BSI). This certification is part of MAC's overall effort to preserve and enhance the environment and protect the safety and health of the company's employees, customers, and neighbours.

Diamonex Product's environmental efforts include recycling, waste reduction and health and safety initiatives, such as fire and emergency preparedness. The division has also undertaken an internal education program to ensure that employees are aware of the steps they can take to improve the environment. Diamonex Products is one of only 3,890 United States' companies to achieve this accreditation and one of only 74,000 companies worldwide.

Diamonex received the ISO:14001:1996 accreditation on December 22, 2004 and will be re-evaluated every six months through continual assessment visits.

"This tremendous achievement is the result of many peoples' efforts," said Jonathan Sands, the Quality Manager at Diamonex. "Our integrated ISO 9001:2000 & ISO 14001 Management Systems are an important asset to the organization's activities," said Richard Hobbs, General Manager at Diamonex.

### ABOUT ISO 14001

ISO 14001 is a management system that empowers an organization to address the impact on the environment of its activities, services, products and people, and to take steps to identify significant aspects, and implement environmental management programs to control and improve them.

### ABOUT BSI

BSI Management Systems is the North and South American hub of BSI, the world's leading international standards, testing, registration and certification organization. Founded in 1901, BSI has issued more than 35,500 registrations in over 90 countries. As the world's first national standards body, and a founding member of the International Organisation for Standardization (ISO), BSI facilitated and published the first commercial standards to address quality management systems, environmental management systems, occupational health and safety management systems, and project management.

JANUARY 2005