

## 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 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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Advanced solutions  
for the  
Healthcare sector

## New solutions for complex and technologically demanding problems

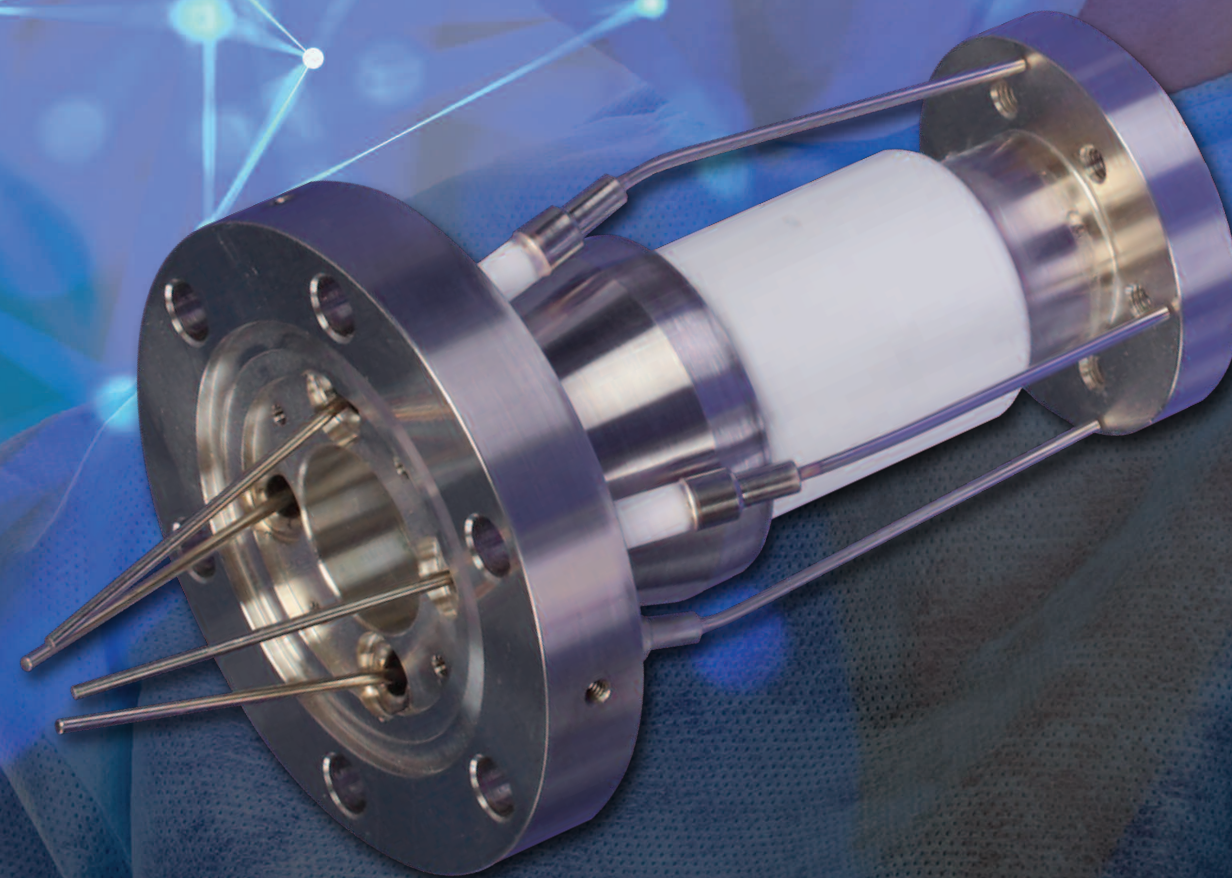
There are significant trends shaping our modern world. Increasingly, resources are becoming more scarce and harder to access, our climate and environment is changing, and the pace of innovation and technology change is accelerating.

Each of these directly or indirectly puts more demand on materials, and so advanced materials have never been more important. Morgan's highly experienced scientists and application engineers actively engage with customers, to find new solutions for complex and technologically demanding problems. This goes hand in hand with our commitment to the environment, to health and safety, and to operating to a high-ethical standard.

# Innovative solutions for medical devices and healthcare instrumentation

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Morgan Advanced Materials produces components used in medical monitoring, diagnostic instrumentation and tools for treatment and surgery.

Medical engineering demands the highest standards of precision, accuracy, reliability, and performance. Equipment manufacturers and medical professionals choose our materials for their exceptional physical characteristics. Our experts collaborate with medical scientists and device manufacturers to source, refine and engineer materials that facilitate specific advances in diagnostics, surgery, therapy, and treatment.

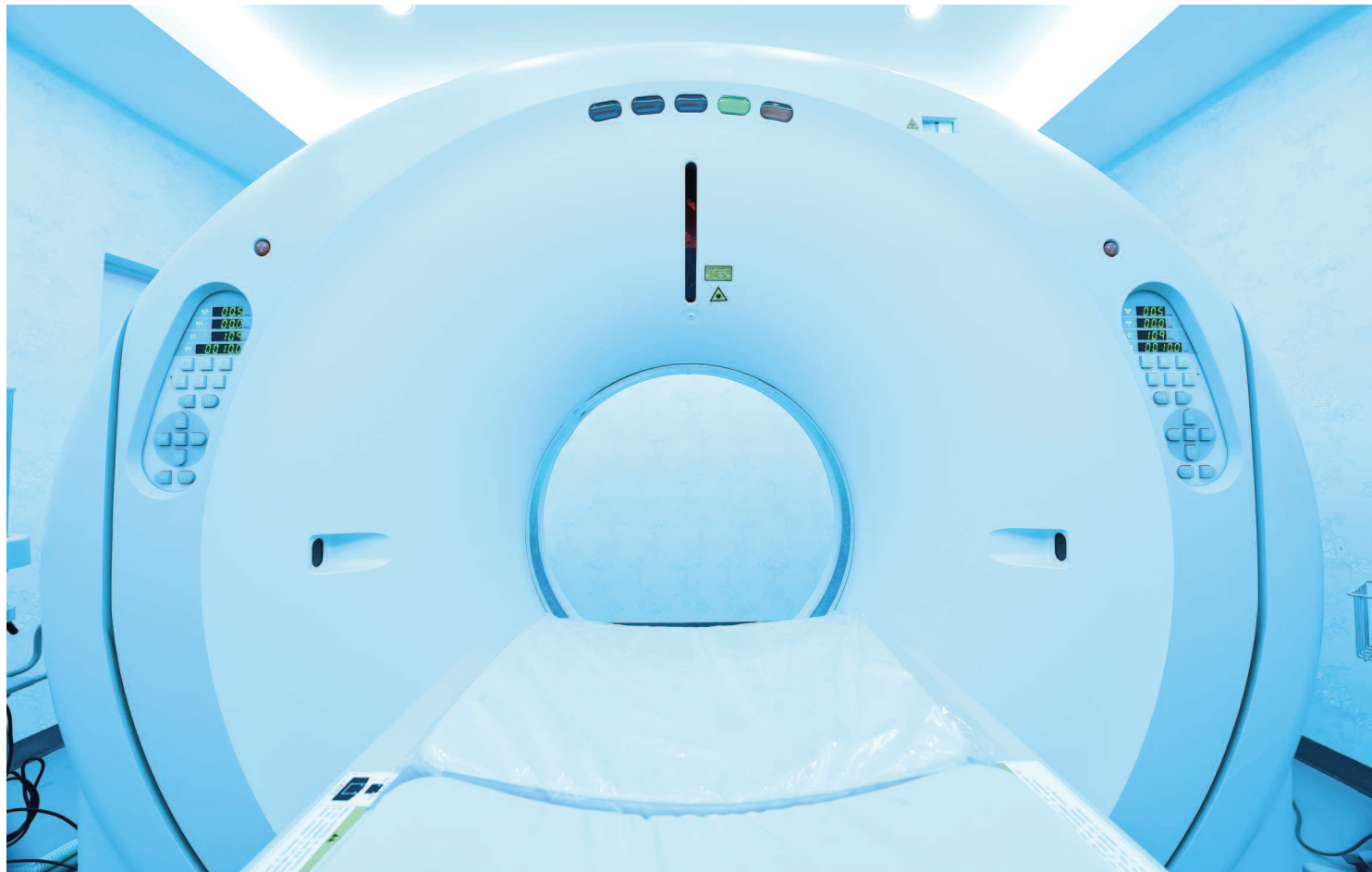


We make high-quality ceramic implants, components and complex assemblies for a wide range of medical devices. Over five decades of experience has given us a firm understanding of the uniquely demanding environment in which equipment for the global medical market is developed. Our capability in materials innovation and quality manufacturing allows us to produce parts that are optimized to meet complex physical and chemical specifications. The result is outstanding, reliable performance in each application, from electrosurgical cutting tools to pacemakers implanted in the human body.

### Typical applications for our products include:

- BLOOD ANALYSIS / CYTOMETRY
- COCHLEAR IMPLANTS
- LASERS
- MRI AND CT SCANNERS
- PACEMAKERS
- RADIATION THERAPY
- SURGICAL INSTRUMENTS
- X-RAY EQUIPMENT

At Morgan, our purpose is to use advanced materials to help make more efficient use of the world's resources and to improve the quality of life



## X-ray and CT tubes

With over 50 years' experience, Morgan is an industry leader in the design and manufacture of alumina X-ray and CT tubes.

Our high-purity engineered components help equipment manufacturers produce machines that meet these requirements. Our X-ray tubes are manufactured from 95 to 97% alumina and are custom built to satisfy the most demanding of customer requirements for some of the world's leading medical X-ray systems and CT scanners device manufacturers. All of our tubes feature superior mechanical properties and a ISO 9001 quality-assured seal to ensure unrivalled performance.



## Metallized components

Our high performance aluminas like Al-300 and Al-995 have a combination of hardness, strength, and temperature resistance giving it excellent capabilities for service in a wide range of applications where high dielectric strength and durable hermeticity is demanded.

Metallization paints are specially formulated to match the various grades of alumina we produce. This ensures critical reliability and the highest bond strength between the metal and ceramic components.

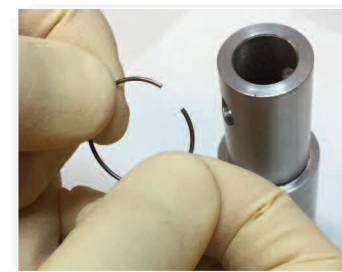


Key features for alumina:

- Low dielectric loss at high frequency
- High mechanical strength
- Vacuum integrity
- Good thermal conductivity
- High electrical volume and surface resistance

## Braze alloys

Wesgo brand braze alloys have been recognized as the highest quality formulations for precious and non-precious braze alloys. Our products are low vapor pressure braze alloys vacuum cast on site and formed to final form. These final shapes can be preforms, wire, paste, rings, powder, washers or sheet.



Beyond more traditional alloys, we also produce active alloys used to wet and bond to non-metal surfaces on materials such as ceramics, diamond and composites. Flexicore™ alloys allow various brittle alloy formulations to be formed into flexible wire, eliminating the need for paste in many applications, while improving repeatability.



### Ultinex™ Active Brazing Services

As the commercial originators, manufacturing and testing active alloys, we have a broad range of experience in joining non-traditional materials for challenging applications. This background has allowed us to develop specific proprietary process steps, we have named the Ultinex™ process. From small scale development assistance, to high volume production, the Ultinex™ process delivers consistent results.

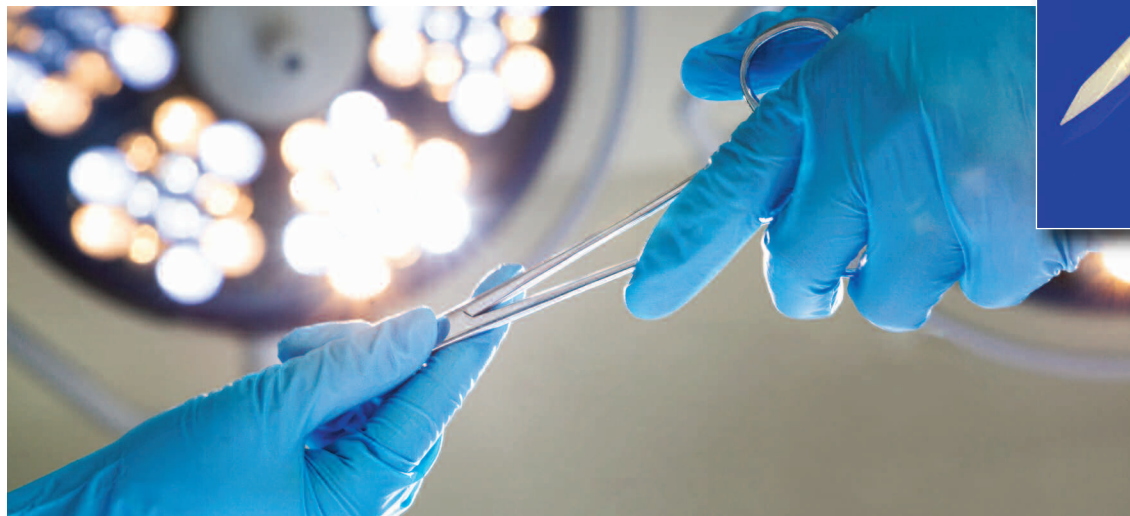


With over 50 years experience, Morgan is an industry leader in the design and manufacture of alumina X-ray and CT tubes

## Surgical instruments

Morgan's superior Ceramic Injection Moulding (CIM) capability is ideal for the engineering of intricate features on surgical instruments. These CIM components, combined with our brazing capabilities allow us to make more hermetic, functional assemblies.

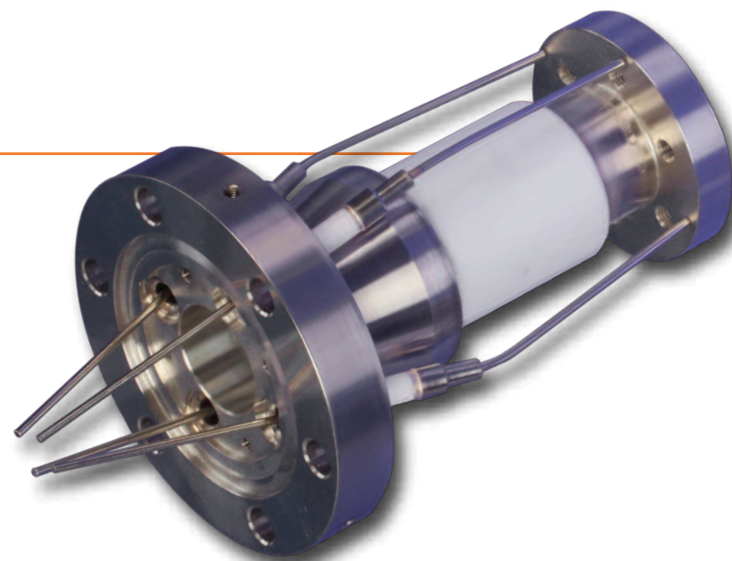
Diamonex® Diamond Like Carbon (DLC) coatings provide a biocompatible, sterilization compatible, non-leaching, low-friction, and wear resistant surface for key pivot points and wear surfaces. Medical grade alumina and zirconia can be used to manufacture ablation and probe tips. The unique thermal properties of our silicon nitride helps to control cooling and prevent cracking during the production of dental restorations. Morgan also provides specialized bearings for pumps used within the dental sector.



## Feedthroughs

Our ceramic feedthroughs are ceramic to metal assemblies used to transmit signals, high voltages and high currents from outside a hermetically sealed chamber to the inside.

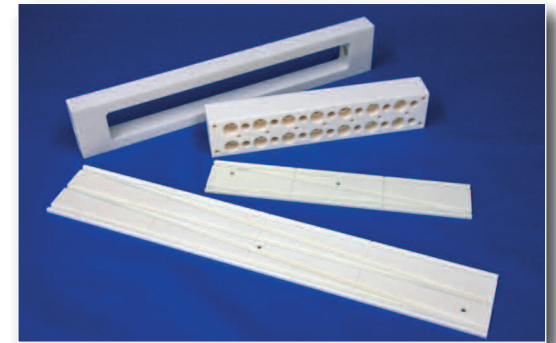
Our feedthroughs are hermetic and able to maintain the ultra-high levels of vacuum and joint integrity that is required at elevated temperatures to cryogenic conditions.



## Excimer and CO<sub>2</sub> laser components

Our high-purity AL995® alumina components are produced to tight tolerances and incorporate a top surface finish in order to provide excellent reflectivity.

Surfaces can be bonded to produce an inert, gas tight assembly.

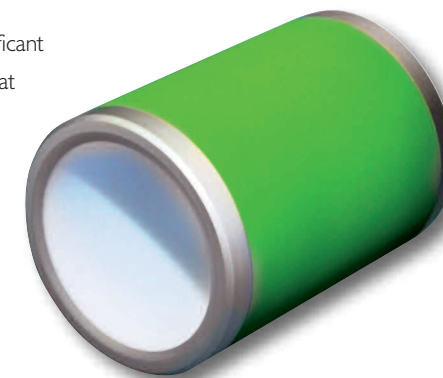


## Charge Dissipative (CD) coating

One of the biggest drivers in the medical diagnostic imaging equipment market is the need for smaller and lighter weight X-ray sources. For imaging systems such as Computed Tomography (CT) scanners, technology is shifting towards smaller size and reduced rotating mass. Likewise, the growing popularity of mobile X-ray machines places the emphasis on convenience and manoeuvrability.

While the desire among manufacturers is to reduce system size, there is also the demand for improved resolution and imaging performance, which can be achieved by using higher-operating voltages. This is where Morgan's CD coatings provides a major benefit. Coating of the ceramic parts facilitates optimum performance at higher voltages.

Morgan Advanced Materials is making significant advancements with its new capability to coat components with a tailor-made Specific Surface Resistivity (SSR).



Our CD coatings enable medical equipment manufacturers to operate at higher voltages at a reduced size

## Seals for blood apheresis devices

Morgan is one of the world's largest manufacturers of seals for automated blood collection devices, producing millions of seals every year.

Quality is critical for this product, with zero failure rate a common requirement. The high-hardness of our materials combined with expert secondary processing enable us to achieve exceptional flatness and surface finish. This ensures we meet the most stringent regulations on liquid-tight sealing.



## Biocompatible, high-film cohesion

The Diamonex® range of thin film medical coatings have been specifically developed to provide hermetic and biocompatible coatings with excellent cohesion properties and wear couples.

Extreme applications have included artificial joints and heart-assist devices where coating integrity and adhesion, combined with the need for extended component life and the ability to interface with the human body without degradation, are of paramount importance.

## Implantable feedthroughs

Morgan's experience in feedthrough design, including biocompatible metal to ceramic assemblies, allows our customers more flexibility in their product development.

Our engineering capabilities in ceramics, braze alloys, precious metals, and hermetic sealing technology allow us to continually reduce the dimensions of our feedthroughs.

These are manufactured at our ISO:13485: 2003 certified facility.



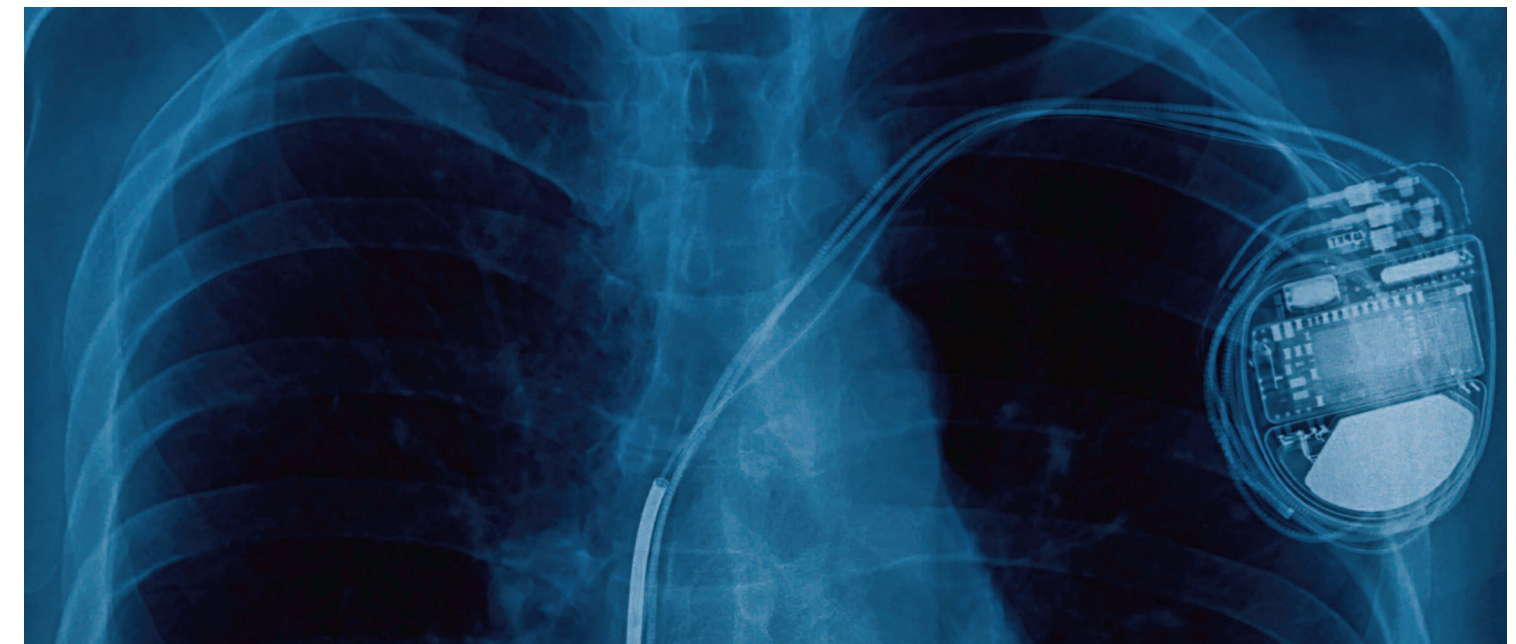
## Surgical implants

Survival in the demanding environment of the human body requires stringent quality control and consistent repeatability.

Morgan's ceramic to metal seal assembly technology is used for implantable pacemakers, defibrillators, neurostimulators and housings for cochlear implants. These housings can be made of Vitox® (alumina) or Vitox® AMC.

Morgan offers Ceramic Injection Moulding (CIM) which is a cost effective, innovative forming technique.

CIM can be used to manufacture parts, in medium to large volumes, with high geometric complexity, and to tight tolerances of  $\pm 0.5\%$ , such as dental abutments and copings.



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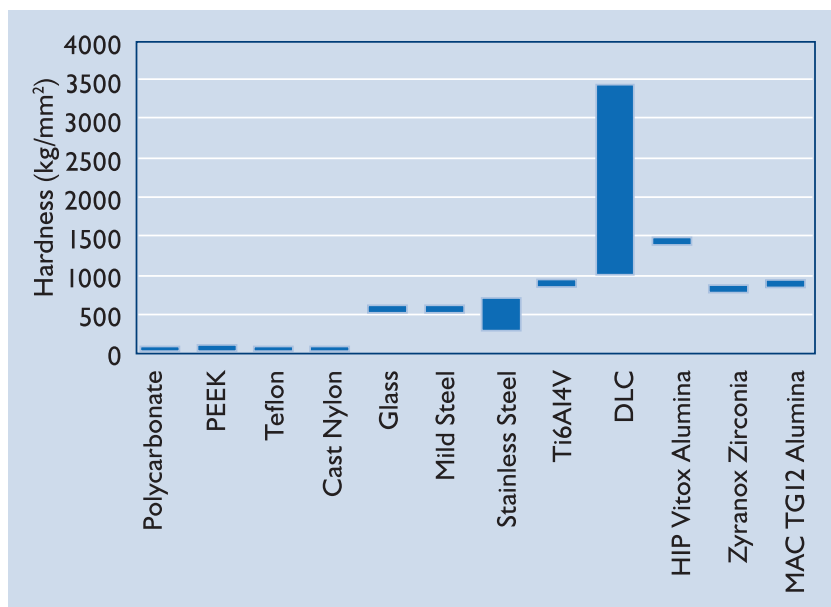
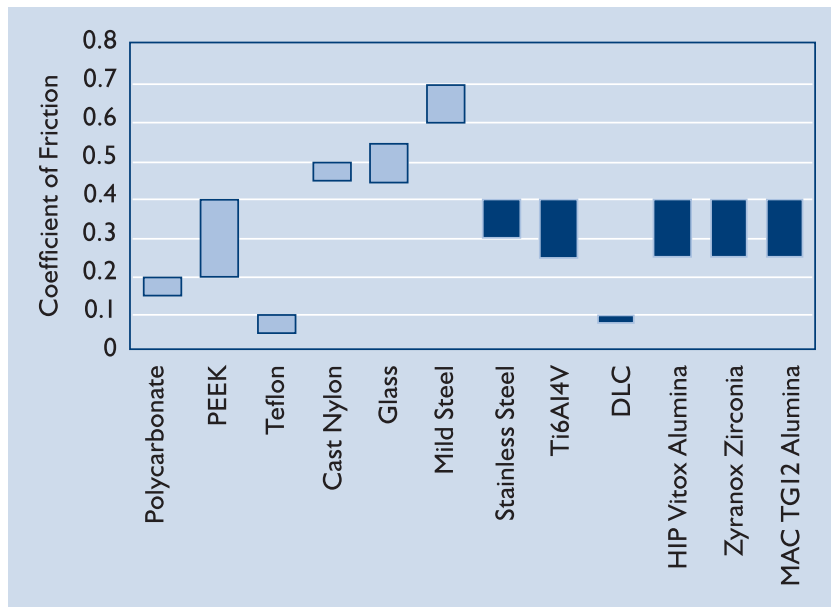
## Materials we work with

We have a large range of materials in our portfolio and will work with you to select the optimum one for your application.

### Materials

- Alumina
- Braze Alloys (including ABA® Active Braze Alloys)
- DLC (Diamond-Like Carbon) Coating
- Glass Preforms (Seals)
- Macor® (Machineable Glass Ceramic)
- Silicon Carbide (SiC)
- Silicon Nitride (Si<sub>3</sub>N<sub>4</sub>)
- Zirconia (TZP)
- Zirconia Toughened Alumina (ZTA)
- Carbon Fibre Composite

Typical physical properties of medical grade materials:



### Coatings

Our Charge Dissipative (CD) coating capability for ceramic parts is enabling the medical diagnostic imaging equipment market to meet the need for smaller and lighter weight X-ray sources. Used in imaging systems such as Computed Tomography (CT) scanner, technology, our CD coated parts facilitate optimum performance at higher voltages. Morgan is making significant advancements with its capability to coat components with a tailor-made Specific Surface Resistivity (SSR).

## Innovating in medical devices & healthcare instrumentation

### Improving tumor treatments

**70%**  
Reduction in hospital recuperation time



Our precision-engineered tips are being used in a new treatment to ablate tumors. The minimally invasive procedure means that patient trauma following surgery is reduced and post-operation recovery times are significantly shorter.

### X-ray and CAT scanners

**2x**  
The speed of conventional scanners



Our components are increasingly used in X-ray and CAT scanning machines in preference to traditional glass. The high-purity, engineered components help equipment manufacturers produce machines that offer longer life, higher power and better performance.



Our capability in materials innovation and quality manufacturing allows us to produce parts that are optimized to meet precise complex physical and chemical specifications