

Injection Moulded Ceramics and Waxes For the Investment Casting Industry



Morgan Advanced Materials

Morgan Advanced Materials is a global materials engineering company which designs and manufactures a wide range of high specification products with extraordinary properties, across multiple sectors and geographies.

From an extensive range of advanced materials we produce components, assemblies and systems that deliver significantly enhanced performance for our customers' products and processes. Our engineered solutions are produced to very high tolerances and many are designed for use in extreme environments.

The Company thrives on breakthrough innovation. Our materials scientists and applications engineers work in close collaboration with customers to create outstanding, highly differentiated products that perform more efficiently, more reliably and for longer.

Morgan Advanced Materials which has more than 10,000 employees across 50 countries serving specialist markets in the energy, transport, healthcare, electronics, security and defence, petrochemical and industrial sectors. The company is listed on the London Stock Exchange (ticker MGAM).

The Certech name is synonymous with the manufacture of ceramic cores predominantly for aerospace and industrial turbine applications. Our cores allow the creation of internal cavities during the investment casting process that are too complex or too small to be shelled. We also manufacture wax injection moulded cores, porous ceramics and various foundry supplies.

Why choose Morgan Advanced Materials

- MARKET LEADING R&D RESOURCES
- COMPREHENSIVE INSPECTION SERVICES
- LARGE CAPACITY FOR FULL OUTSOURCING AND ASSEMBLY
- REDUCED SCRAP AND ASSOCIATED MACHINERY RUNNING COSTS
- IMPROVED CASTING YIELDS USING OUR CERAMIC CORE AND WAX PRODUCTS
- CREATION OF COMPLEX, INTRICATE VOIDS WITH EXTREMELY THIN TRAILING EDGES
- TRIALLING OF WAX PATTERN DIES
- SHORT LEADTIMES (AS LITTLE AS 24 HOUR TURNAROUND FOR WAX INJECTIONS PRODUCED IN THE UK)

Commercial Cores

Morgan manufactures an extensive variety of cores to a very diverse customer base. Our cores are used in the manufacture of Titanium Castings, Fuel Pumps, Automotive Components, Surgical Implants and Equipment and much more. Production runs into millions of pieces are not uncommon for some of these applications.



Airfoil Cores

Equiax Core Materials

One of the basic considerations of the modern gas turbine engine is the high turbine inlet temperature. These critical airfoils are investment cast in nickel and cobalt-based superalloys, with ceramic cores used to form the part's air-cooling passages.

We can inject thin ceramic sections with excellent strength and where necessary we are able to offer additional strength by injecting around quartz inserts down to 0,5 mm (0.020") in diameter. This has provided our customers with the freedom to design features in the cooling passages that would otherwise be difficult to form. For over forty years, Morgan has been a leader in the manufacturing of ceramic cores.

Our leadership in the production of complex ceramic cores has been the result of our dedication to advanced technology and servicing the needs of our customers.



Single Crystal and Directional Solidification Material

At Morgan, we take pride in the production capabilities of our well-equipped, professionally staffed plants worldwide and are personally committed to solving the most challenging product assignments. We work closely with our customers in meeting specific design requirements in a cost-effective and timely fashion. Our highly skilled laboratory technicians utilise state-of-the-art testing equipment to monitor and control modulus of rupture, tensile strength, thermal expansion and cristobalite determinations - all critical variables in the D.S. / Single Crystal casting process.

Industrial Gas Turbines

Over the next decade thousands of Industrial Gas Turbine generators will be needed to meet the world's demand for power. Morgan has invested in capacity and technology to meet this demand and the increasing requirement for spares. Our range of materials and unique core process capability enables Morgan to manufacture a wide range of sizes and design complexity for both Equiax and DS castings. The uniqueness of the process provides short lead-time and the capability of high volume production requirements. The utilisation of CMM inspection for dimensional data capture provides the customer with individual product dimensional capability, through the casting process, as well as illustrating the core process capability.



Core Preparation and Coating

Morgan can offer a range of coatings during the core preparation process, including:

- | KRI a water based resin is used to strengthen each core to help withstand the Wax Injection operation.
- | Urea treatment used to strengthen cores allowing them to better withstand the casting process.
- | Alumina coatings to prevent metal interaction between casting and the core.



Impregnation Process

- | KRI an aqueous based solution is impregnated into the cores under vacuum and dried in an oven to drive off water.
- | Urea is melted from solid pellet form and held as a liquid. The core is immersed into the Urea and enters the pores via capillary action. Cores are left to cool to solidify the Urea.

Increased Strength

- | The table below shows the average MOR (at room temperature) for one of our materials un-impregnated and then when impregnated with KRI or coated with Urea.
- | As you can see the strength of the testbar is significantly increased when one of our impregnation methods is used.

Un-impregnated (Average)	KRI (Average)	Urea (Average)
11.56MPa	29.41MPa	35.71MPa

Wax Preparation

To enable the casting process to be more efficient, we offer wax preparation of our ceramic cores prior to shipment. Prepped according to customer specifications utilizing various materials such as melted waxes for filling, super glue, wax glue, and chaplet application, ceramic cores of all sizes and shapes can then immediately proceed to the wax injection process when received at the foundry, saving valuable time and money.

Foundry Products

Morgan Advanced Materials manufactures a wide range of foundry products using their proprietary injection moulded pure refractory materials. These products have excellent thermal shock resistance. All of these items can be customised to suit your specific requirements, however, we also have a standard range of products available on request.

Crucible Liners

In a range of sizes from 9-25kgs (20lb to 55lb) shot capacity, these have proved to be extremely successful in reducing non-metallic inclusion developed during the vacuum melting process.

Pouring Cups

Most of these products are customized to accommodate the customer's feed system. The use of these products is ideal when a customer wants peace of mind that his alloys are in contact with certified trace element ceramic materials.

Filters

These come in a range of sizes and slot sizes. They have excellent thermal shock properties and their exceptional design allows for efficient removal of floating slag, in stream slag, inclusions and dross to provide clean metal for castings.

We also manufacture a variety of other items such as Down Pole Plugs, CLA Casting Snouts and Mould Covers.

Details are available on request, but most of these items are customised to suit individual customer needs.



Wax Injection and Assembly

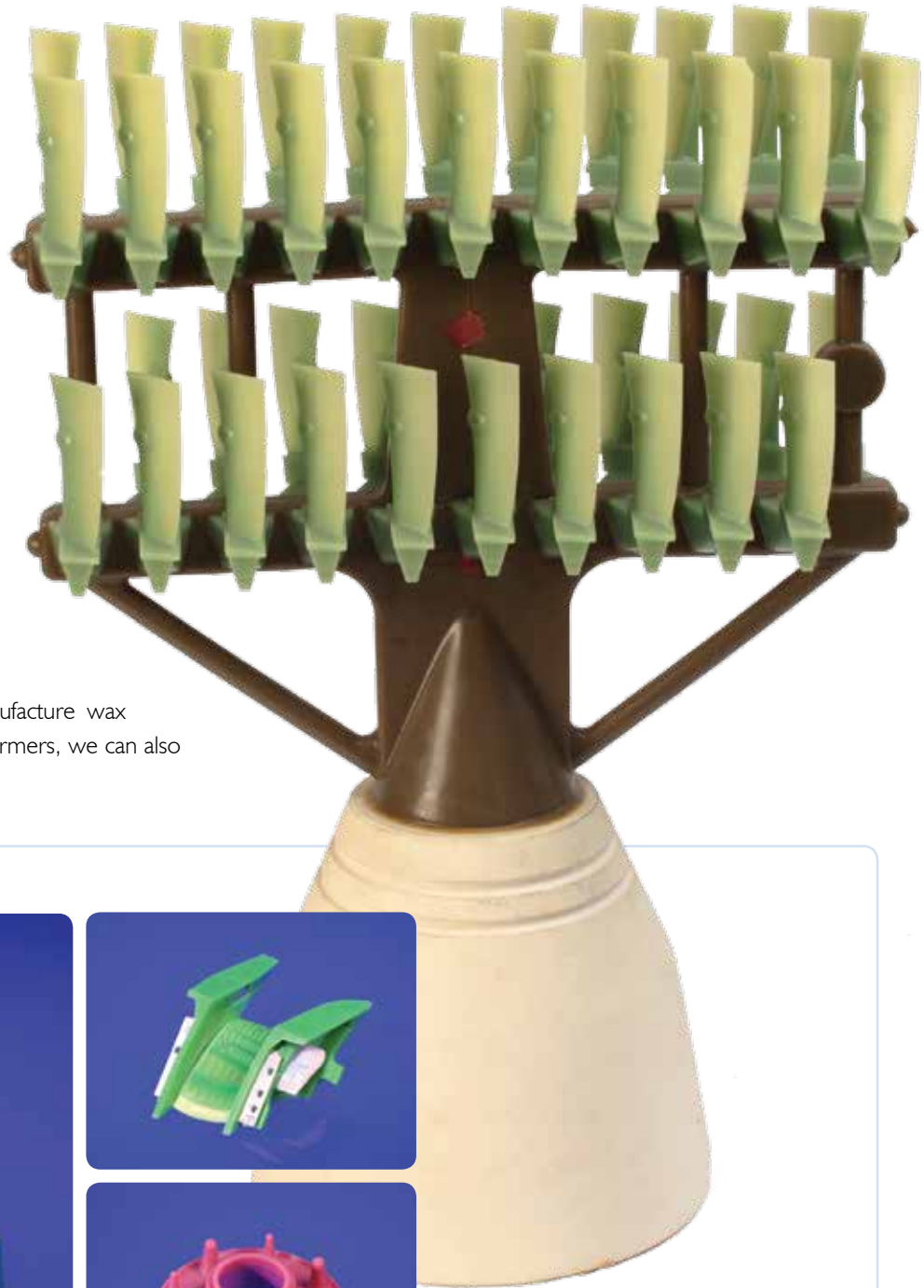
Morgan specialise in the development and production of Wax Injection and Assembly

Our specialist Engineers have extensive experience of working closely with customers to ensure the best raw materials are selected to match your process, with wax pattern tooling and associated auxiliaries being developed to your exact specifications.

We have the ability to support the supply of cored and solid wax patterns, runner and full wax assembly systems, including pouring cup assemblies. We also specialise in the production of Equiax, DS and SX assemblies and patterns.

We work with customers that do not have the capacity to perform these functions in-house providing services such as, X-ray, ultrasonic inspection, wax engraving and barcode labelling of wax patterns and runner systems.

Our expertise enables us to specify and manufacture wax pattern injection dies along with setters and reformers, we can also test tooling prior to delivery.



Wax Injection and Assembly is currently available in the UK only

MORGAN ADVANCED MATERIALS
MANUFACTURING LOCATIONS



Our manufacturing sites are ISO 9001 certified

For all enquiries, please contact our specialist sales and manufacturing sites:

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