

Metal Injection Moulding

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What is Metal Injection Moulding (MIM)

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. Common binders are a combination of waxes and organics, which may include thermoplastic or thermoset materials as well as surfactants and other additives. The feedstock is then injected into a mould cavity using moulding machines very similar to those used in plastic injection moulding. The majority of binder system is then removed using a thermo/chemical operation. The parts are then placed in a sintering furnace where any remaining binder is removed and the parts are sintered to their final dimensions. The end result is a near net shape part with a typical density of 98+%. Depending on the part, this can be the final step unless there are any secondary operations to be performed.



The benefits of MIM

- Cost effective method of producing small complex geometric metal components in high volumes with comparable material properties of traditional machined parts
- Ability to mould cross-drilled holes, radii, blind holes, internal features etc with tight tolerances in one shot, with no secondary machining
- Able to mould several SST's (17-4 PH, 316L, 304L) along with other metals such as Kovar, Cu and Tungsten Alloys

Materials

- 17-4 PH SST
- 316L SST
- 304L SST
- F-15 Alloy
- Other materials upon request

Markets

- Aerospace
- Chemical
- Communications
- Defence
- Electronic
- Medical

All Morgan Advanced Ceramics manufacturing sites hold ISO 9000 approvals

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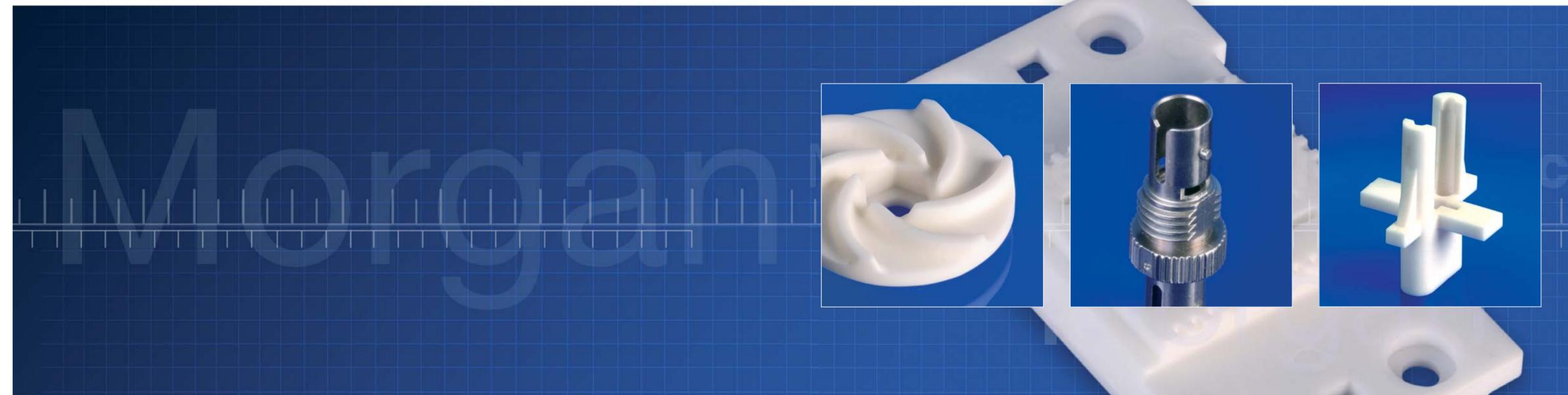
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CERAMIC AND METAL INJECTION MOULDING CAPABILITIES



A highly developed forming technique delivering repeatable, ultra high precision advanced ceramic and metal components of great geometric complexity.

Metal Injection Moulding

Ceramic Injection Moulding



Morgan Advanced Ceramics

Morgan Advanced Ceramics is a leading supplier of innovative solutions in a comprehensive range of materials, and forms part of the Morgan Crucible Company Plc. Using state of the art, fully integrated manufacturing processes and utilising core competences of applications engineering with superior materials technology, we deliver intricately shaped Ceramic Injection Moulded (CIM) and Metal Injection Moulded (MIM) components for a variety of global customers.

Customer services

With a world-leading reputation and manufacturing sites on three continents, an extensive sales and technical support network exists to provide the structure and capability to work with global businesses at national and international level.

Why should CIM and MIM be considered

The continuous strides forward in science and technology lead to ever increasing demands on materials. Ceramics and metals have significant advantages characterised by their outstanding physical, chemical, mechanical, thermal and/or electrical properties. This opens the door to a wide variety of application possibilities when other materials fail to perform, while maintaining great versatility and freedom in the design of components.



Ceramic Injection Moulding

What is Ceramic Injection Moulding (CIM)

The CIM process begins with very fine ceramic powders. Using sophisticated mixing technology the powders are compounded with thermoplastic binders to produce a homogeneous pelletised feedstock. The binders form a liquid medium which carries the ceramic powders into the mould during the injection stage. Using an injection moulding machine similar to that used in conventional plastic moulding, the molten feedstock is forced into a mould cavity forming a net shape part. Moulds can be single or multi-cavity configurations. After forming the part it then goes through two thermal processes. First is pyrolysis to remove the binder, followed by sintering in a high temperature kiln to form a fully dense ceramic component. During sintering the component shrinks uniformly by as much as 20% while retaining the complex shape. With good process control close tolerances can be obtained, therefore machining of the part after sintering is usually not necessary.



The benefits of CIM

- Provides unique, economic solutions to increasingly stringent material and product design requirements
- Excellent batch to batch repeatability and process capabilities achieving a tolerance of +/- <0.3%
- High surface finish quality without the need for additional finishing processes
- Accommodates extremely complex geometric components
- Superior material performance, high hardness and mechanical strength, wear, corrosion and weathering resistant, dimensionally stable, high working temperature and good electrical insulator
- Also used for metallised applications

Materials

- TG12 - high purity 99.5% Alumina
- Zirconia Toughened Alumina (ZTA)
- Zyranox® Zirconia

Markets

- Aerospace
- Automotive
- Chemical
- Communications
- Electronic
- Medical

Tools paramount to the success of the CIM process

Mould Flow Analysis

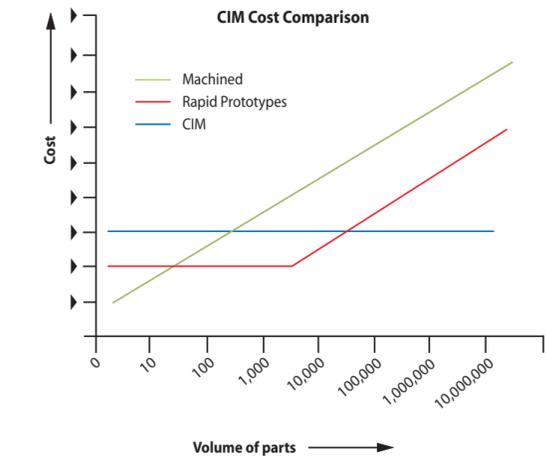
Mould flow simulation allows optimisation of the part and mould design by adjusting areas such as gate positions, wall thickness and cooling parameters to help achieve success. Mould flow simulation is usually conducted during the product design stage or the early stages of the tool design to eliminate many of the problems associated with commissioning an injection mould, before construction and major investment in the mould has even begun.

Cavity Pressure Control

Jobs with high volume and tight tolerances demand a level of capability that can only be achieved with cavity pressure containment and control. Cavity Pressure is the process variable that correlates most directly with part quality. Morgan Advanced Ceramics use this to monitor characteristics such as part weight, dimensions, flash, sinks, shorts and warp. When deviations are detected and contained, part quality to the customer can be assured. With cavity sensors, we have the ability to navigate without reference to the horizon. Conventional moulding is similar to a pilot flying in the clouds without even a compass.

Rapid Prototypes

The constant need to accelerate time to market is clearly recognised by Morgan Advanced Ceramics. More than ever, today's businesses must be swift and agile. To ensure customers maintain their competitive position the company provides the most cost effective, reliable and dependable path to meet product development timeframes. Rapid prototyping supports this enabling a fast-track path from concept to production samples. Utilising rapid tooling methods and CNC machining techniques, it is possible to produce CIM components from a 3D CAD model in a short time-scale with minimum investment. Suitable for low volumes to allow customers to see and feel production-like CIM components during their development stage prior to investing in high volume production tooling.



■ Machined – Suitable when very low volumes are required in the tens range. Components would be CNC machined from green blanks.

■ Rapid Prototypes – Referring to manufacturing a rapid prototype CIM tool. Capable of producing CIM components in small volumes, typically hundreds to low thousands range.

■ CIM – A full CIM production tool capable of producing repeatable parts in high volumes, from tens of thousands up to and beyond one million components.

