

COMPLEX INJECTION MOLDED CERAMIC COMPONENTS

Ceramic injection molding offers economic and design advantages over conventional forming processes in the production of high precision, complex ceramic components:

- Design freedom – one process can accommodate different profiles, geometries and wall thicknesses
- Unique features include internal and external threads, thin walls and small holes
- Low tooling costs

Design considerations

This information is intended as a guide to the design of ceramic components made by this type of low pressure injection molding process.

Maximum product dimensions:

Dense ceramics: 100mm
Porous ceramics: 150mm

Maximum wall thickness:

Dense ceramics: 6mm
Dense zirconia: 5mm
Porous ceramics: 10mm

There are restrictions on wall thickness to allow the binder to be removed during the firing process. If part of the component is thicker than is recommended, it may be possible to incorporate bleed holes to aid binder removal.

Minimum wall thickness:

0.5mm depending on wall length

Minimum hole diameter:

0.13mm depending on hole length

Tolerances:

The most economical parts are "as molded", which require no diamond machining after firing. The "as molded" tolerances are a function of the actual dimensions:

Dimensions (mm)	Tolerance (mm)
0 – 2.5	± 0.03
2.5 – 6.0	± 0.05
6.0 – 12.0	± 0.13
12.0 – 100.0	± 1

PROPERTY	A998	A96	A9468	A9968	MUL6	PSZ
Composition (weight %)	99.8% Al ₂ O ₃	95.9% Al ₂ O ₃	94% Al ₂ O ₃	99% Al ₂ O ₃	72% Al ₂ O ₃	5.4% Y ₂ O ₃ 94% ZrO ₂
Density (g/cm ³)	3.89	3.67	2.60	2.90	2.10	6.00
Porosity (%)	0	0	~30	~25	~30	0
Hardness (GPa Knoop)	11.1	11.1	n/a	n/a	n/a	11.7
Flexural strength (MPa)	325	320	82	117	62	600
Coefficient of thermal expansion (x10 ⁻⁶ per °C) 25-700 °C	7.5	7.2	~7	~7	~5	11.2
Thermal conductivity (W/m °K) 20 °C	35	24	~15	~24	~4	2
Max. use temperature (°C)	1650	1550	1550	1550	1550	2200

Properties shown are typical values, they are not absolute material properties, and should be used for guidance only. It is recommended that materials and components are tested for their suitability for a specific application.

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