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Mechanical Properties of MIM Components at CMG Technologies

The density and performance of MIM parts are comparable to those of wrought and cast components. Even with machining and casting, parts may not be 100% dense as there will often be inclusions, mainly in cast components.

Due to the nature of the process, there will be some porosity left in the component after the sintering stage, however, what porosity is left will be very fine and isolated. Generally after the sintering stage the theoretical density of the components we produce will be controlled to within the range of 95 - 98% dense. To be gas tight (i.e. to have no interconnected porosity) the density of a component needs to be above 91-92% dense. Parts that we make are currently used in gas analysis and hermetic packaging where the drawings have very stringent tolerances on porosity and we can now produce parts with wall sections as thin as 0.5mm which are hermetic to greater than 10^{-10}.

Table 1 lists typical mechanical property data for a range of materials processed by MIM. Comparison with wrought materials is not straightforward because data for identical compositions are not available, but the data in table 2 are indicative. (Source: European Powder Metallurgy Association)

Table 1 (Source: European Powder Metallurgy Association)

Selected Mechanical Properties of MIM Metals and Alloys					
Material	Fractional density	Yield strength, Mpa	Ultimate Strength, Mpa	Elong.%	Rockwell hardness
Iron	0.96	105	220	35	F50
Stainless Steel 17-4PH	0.96	965	1030	12	___
Stainless Steel 316L	0.96	220	510	45	B75
2% Nickel Iron	0.96	190	345	30	B55
Kovar	___	295	460	36	B70
Hastelloy	0.97	350	800	40	C30

Table 2 (Source: European Powder Metallurgy Association)

Comparison of MIM Properties with Wrought Materials			
Material	Yield strength, Mpa	Ultimate Strength, Mpa	Elong.%
0.24% carbon steel (Wrought)	215	430	21
0.20% carbon steel (MIM)	185	380	23
316L Stainless steel (Wrought)	249	545	67
316L Stainless steel (MIM) (At a density of 95%)	273	547	49