



Metal Materials

DMLS materials from EOS vary from bronze-based alloys to tool steel and stainless steel. Light metals on the basis of titanium and super alloys, for example cobalt-chrome, have already been developed at EOS for use in EOSINT M systems. Such alloys are especially interesting for applications in the medical device industry, as well as in aerospace.

EOS MaragingSteel MS1

EOS MaragingSteel MS1 is a maraging steel in fine powder form. Its composition corresponds to US classification 18 Maraging 300, European 1.2709 and German X3NiCoMoTi 18-9-5. This kind of steel is characterized by having very high strength combined with high toughness. It is easily machinable after the building process and can be easily post-hardened up to approx. 55 HRC by a simple thermal age-hardening process. This kind of steel is conventionally used for complex tooling as well as for high-performance industrial parts, for example in aerospace applications.

Typical applications:

- heavy duty injection moulds and inserts for moulding all standard thermoplastics using standard injection parameters, with achievable tool life of up to millions of parts
- die casting moulds for small series of up to several thousand parts in light alloys
- direct manufacture of heavily loaded functional metal prototypes.

DirectMetal 20

DirectMetal 20 is a very fine-grained bronze-based, multi-component metal powder. The resulting parts offer good mechanical properties combined with excellent detail resolution and surface quality. The surfaces can be easily post-processed by shot-peening and can be polished with very little effort. The specially developed powder mixture contains different components which expand during the laser-sintering process, partially compensating for the natural solidification shrinkage and thereby enabling a very high part accuracy to be achieved.

This material is ideal for most prototype injection moulding tooling applications (DirectTool) and for many functional metal prototype applications (DirectPart). It offers the highest building speed and thus is particularly suitable for larger tools and parts. It also offers a broad window of usable process parameters, e.g. a wide range of achievable mechanical properties and build speeds. Standard parameters use 20 µm layer thickness for the skin and 60 µm layers for the core, but for faster building the entire part can be built using 40 µm layers for the skin and 80 µm layers for the core. Using standard skin parameters the mechanical properties are fairly uniform in all directions, which is especially beneficial for many DirectPart applications.

Areas built with core parameters have a porous structure, but the combination of skin and core produces a strong total part. Parts built from DirectMetal 20 also have good corrosion resistance.

Typical applications:

- injection moulds and inserts for moulding up to tens or even hundreds of thousands of parts in standard thermoplastics using standard injection parameters
- direct manufacture of functional metal prototypes.

EOS StainlessSteel 17-4

EOS StainlessSteel 17-4 is a pre-alloyed stainless steel in fine powder form. Its composition corresponds to US classification 17-4 PH and European 1.4542 and fulfils the requirements of AMS 5643 for Mn, Mo, Ni, Si, C, Cr and Cu. This kind of steel is characterized by having very good corrosion resistance and mechanical properties, especially excellent ductility in laser processed state, and is widely used in a variety of engineering applications.

This material is ideal for many part-building applications (DirectPart) such as functional metal prototypes, small series products, individualised products or spare parts. Standard processing parameters use full melting of the entire geometry with 20 µm layer thickness, but it is also possible to use skin and core building style to increase the build speed. Using standard parameters the mechanical properties are fairly uniform in all directions. Laser-sintered parts made from EOS StainlessSteel 17-4 can be welded, machined, micro shot-peened, polished and coated if required. Unexposed powder can be reused without restriction or refreshing.

Typical applications:

- engineering applications including functional prototypes, small series products, individualised products or spare parts.
- parts requiring high corrosion resistance, sterilisability, etc.
- parts requiring particularly high toughness and ductility.

EOS StainlessSteel PH1

EOS StainlessSteel PH1 is a pre-alloyed stainless steel in fine powder form. This kind of steel is characterized by having very good corrosion resistance and excellent mechanical properties, especially in the precipitation hardened state. This type of steel is widely used in variety of medical, aerospace and other engineering applications requiring high hardness, strength and corrosion resistance.

This material is ideal for many part-building applications (DirectPart) such as functional metal prototypes, small series products, individualised products or spare parts. One potential application is injection moulding tools for processing of corrosive plastics. Standard processing

parameters use full melting of the entire geometry with 20 µm layer thickness, but it is also possible to use 40µm layer thickness and skin and core building style to increase the build speed. Using standard parameters the mechanical properties are fairly uniform in all directions. Parts made from EOS StainlessSteel PH1 can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required.

Typical applications:

- engineering applications including functional prototypes, small series products, individualised products or spare parts.
- parts requiring high corrosion resistance, sterilisability, etc.
- parts requiring particularly high strength and hardness.

EOS CobaltChrome MP1

EOS CobaltChrome MP1 is a fine powder mixture for laser-sintering on EOSINT M 270 systems, which produces parts in a cobalt-chrome-molybdenum-based superalloy. This class of superalloy is characterized by having excellent mechanical properties (strength, hardness, etc.), corrosion resistance and temperature resistance. Such alloys are commonly used in biomedical applications such as dental and medical implants (note: widely used in Europe but much less so in North America), and also for high-temperature engineering applications such as in aero engines.

The chemistry of EOS CobaltChrome MP1 conforms to the composition UNS R31538 of high carbon CoCrMo alloy. It is nickel-free (< 0.1 % nickel content), sterilisable and suitable for biomedical applications. The laser-sintered parts are characterized by a fine, uniform crystal grain structure. They fully meet the requirements of ISO 5832-4 and ASTM F75 for cast CoCrMo implant alloys, as well as the requirements of ISO 5832-12 and ASTM F1537 for wrought CoCrMo implants alloys except remaining elongation. The remaining elongation can be increased to fulfil even this standard by hot isostatic pressing (HIP).

This material is ideal for many part-building applications (DirectPart) such as functional metal prototypes, small series products, individualised products or spare parts. Standard processing parameters use full melting of the entire geometry with 20 µm layer thickness, but it is also possible to use skin and core building style to increase the build speed. Using standard parameters the mechanical properties are fairly uniform in all directions. Laser-sintered parts made from EOS CobaltChrome MP1 can be welded, machined, micro shot-peened, polished and coated if required. Unexposed powder can be reused without restriction or refreshing.

Typical applications:

- prototype or one-off biomedical implants, e.g. spinal, knee, hip bone, toe and dental
- parts requiring high mechanical properties in elevated temperatures (500 - 1000 °C) and with good corrosion resistance, e.g. turbines and other parts for engines, cutting parts, etc.
- parts having very small features such as thin walls, pins, etc., which require particularly high strength and/or stiffness.

EOS CobaltChrome SP1

EOS CobaltChrome SP1 is a fine powder mixture which produces parts in a cobalt-chrome-molybdenum-based superalloy. In addition to excellent mechanical properties (strength, hardness etc.), corrosion resistance and temperature resistance, it has been especially developed to fulfil the requirements of dental restorations which have to be veneered with dental ceramic material.

Typical applications:

- dental restorations (crowns, bridges etc.)

EOS Titanium Ti64 / Ti64ELI

EOS Titanium Ti64 is a pre-alloyed Ti6AlV4 alloy in fine powder form. This well-known light alloy is characterized by having excellent mechanical properties and corrosion resistance combined with low specific weight and biocompatibility. The ELI (extra-low interstitial) version has particularly low levels of impurities.

Typical applications:

- parts requiring a combination of high mechanical properties and low specific weight, e.g. structural and engine components for aerospace and motor racing applications, etc.
- biomedical implants