DMLS - How it works

CRDM currently runs two **Direct Metal Laser Sintering** (DMLS) machines manufactured by **EOS GmbH**
, the
EOSINT M 270
and the
EOSINT M 250
Xtended.

The build process is very simple ...

re-coat build plate > scan layer > move build & dispenser pistons > re-coat build plate ....

All this happens under an inert nitrogen atmosphere and careful gas flow extraction.

Repeating this cycle in steps/layers of either 20 or 40 micron thickness the tool or components are built up in the material. Once finished, the build plate is removed with parts attached, the excess powder is removed and recycled. The parts can then be removed by hand or often wire eroded from the plate.

To ensure the process runs smoothly, slightly different (but simpler) design rules are required for the DMLS process.

The experience of the team at CRDM (we have been running DMLS machines since 1999) allows us to advise on the optimum part design for the dmls process. Optimising the part design ensures good build results, best pricing and fastest delivery.

DMLS parts can be welded, machined, micro shot-peened, polished and coated if required.

Available materials:

Stainless Steel GP1

Stainless Steel GP1 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.

Stainless Steel PH1

Stainless Steel 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 to increase the build speed. Using standard parameters the mechanical properties are fairly uniform in all directions.

Parts made from **Stainless Steel PH1** can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required.

Maraging Steel MS1

Maraging Steel

MS1 is a pre-alloyed ultra high strength steel in fine powder form. Its composition corresponds to US classification 18% Ni Maraging 300, European 1.2709 and German 3NiCoMoTi 18-9-5.

Parts built from **Maraging Steel** MS1 are easily machinable after the building process and can be easily post-hardened to more then 50 HRC by age-hardening at 490 °C for 6 hours.

This material is ideal for many tooling applications (DirectTool) such as tools for injection moulding , die casting of light metal alloys, punching, extrusion etc., and also for high performance industrial and engineering parts, for example in aerospace and motor racing applications.

Standard processing parameters use full melting of the entire geometry, typically with 40 µm layer thickness, but it is also possible to use Skin & Core building style to increase the build speed. Using standard parameters, the mechanical properties are fairly uniform in all directions.

In both as-built and age-hardened states the parts can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required.

Cobalt Chrome MP1

The chemistry of EOS **Cobalt Chrome** 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 fulfill even this standard by hot isostatic pressing (HIP).

DirectMetal 20 (DM20) Nickel-Bronze

DirectMetal 20 is a very fine grained bronze-based 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. The specially developed **DMLS** po wder mixture contains different components which expand during the laser-sintering process, partially compensating for the natural sintering shrinkage and thereby enabling a very high accuracy to be achieved.

This material is ideal for most prototype injection moulding tooling applications and for many functional metal prototype applications (DirectPart).

It offers the highest building speed so is particularly suitable larger tools and parts. It also offers a very broad window of useable process parameters, e.g. a wide range of achievable mechanical properties and build speeds.

Standard parameters use 20 micron layer thickness for the skin and 60 micron layers for the core, but for faster building the entire part can be built in 40 micron layers for the skin and 80 micron for the core, or even 60 micron layers for the skin and core.

Using standard skin parameters the mechanical properties are fairly uniform in all directions, which is especially beneficial for many DirectPart applications.

Parts built from **DirectMetal 20** also have good corrosion resistance. Typical applications for **D M20** would therefore be injection mould tooling for moulding up to a few tens of thousands of parts in all standard thermoplastics using standard injection parameters. And also the direct manufacture of functional metal prototypes.