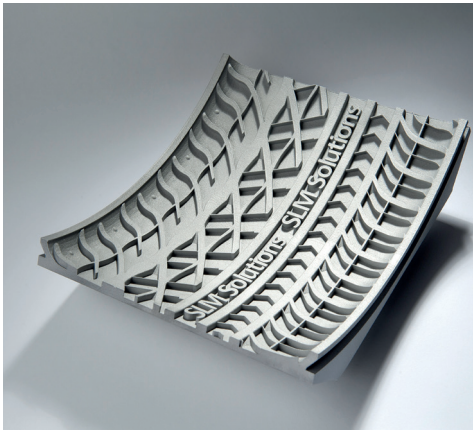


3D Printing of metal products



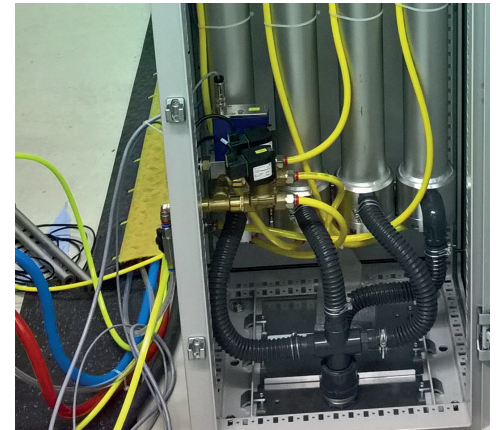
Application note A067-CM04-0117A



- ◆ Tire mould segment
- ◆ Ship's screws
- ◆ Hip joints
- ◆ Dental prostheses

3D-printing, also known as additive manufacturing, is a technique where products are made by building a product layer by layer. This is the opposite of machining operations such as drilling or milling, where pieces of materials are removed to yield the product.

Selective laser melting (SLM) is a 3D-printing technique where a layer of powder is deposited, after which a part of these powder particles is selectively melted together by means of laser heat. SLM Solutions Group AG is a machine builder who makes 3D-printing machines that print metal parts out of steel, aluminium or titanium powder using selective laser melting. Their customers are in the fields of aerospace, automotive and medicine & dental. High purity inert gases are necessary around the metal powder bed within the 3D-printer. Bronkhorst was able to help SLM Solutions Group AG with a suitable system to generate nitrogen shielding gas.



Bronkhorst setup

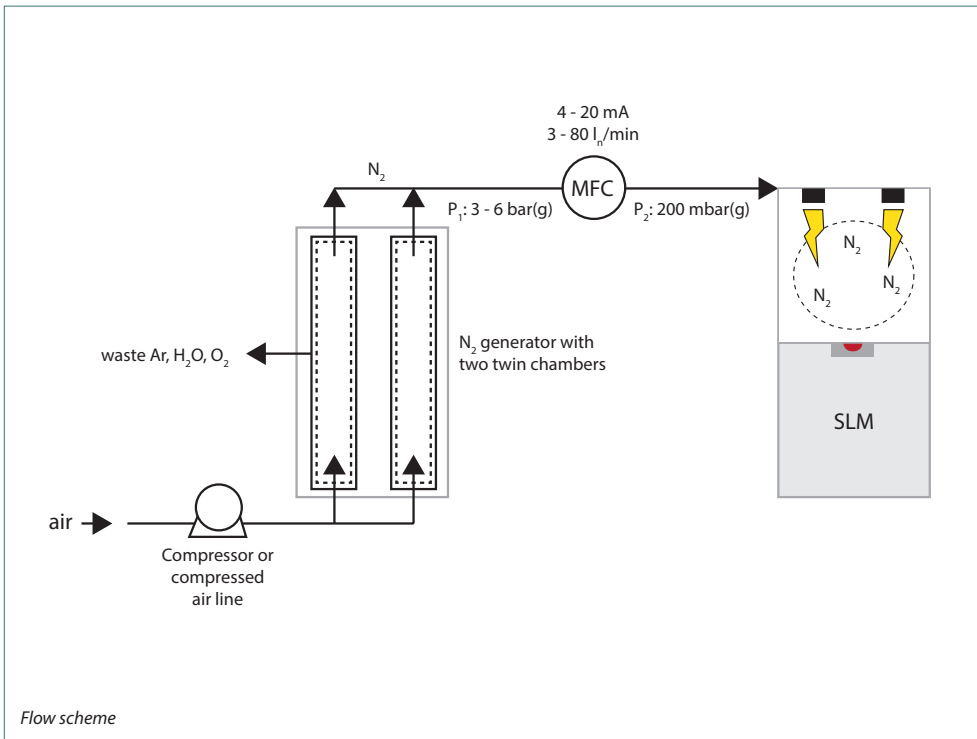
Application requirements

It is essential to have a gas atmosphere around the to-be-melted metal powder particles that is oxygen-free, to prevent the metal from oxidation during the laser melting. To that end, an inert shielding gas has to be applied: argon gas for steel and titanium, and nitrogen gas for aluminum.

Important topics

- ◆ Reliable functioning of mass flow controller for N_2 supply
- ◆ Repeatability is more important than accuracy

Process solution



Flow scheme

For the end user of SLM's 3D-printing machine, there are two ways to establish a nitrogen atmosphere: either from the in-house nitrogen supply mains - if present - or from a nitrogen generator, which is an accessory to the 3D-printer. In the latter option, Bronkhorst becomes involved. Pressurised air from a compressed air supply or a compressor is supplied to the nitrogen generator, and its molecular sieve separates the air flow into two flows. Constituents such as oxygen, water vapour and argon are removed, and nitrogen with high purity (grade 5.0) remains.

Downstream of the generator, a Bronkhorst MASS-STREAM™ D-6300 mass flow controller is installed to control the nitrogen flow to the 3D-printer. This controller works in two operating modes. Prior to the printing process, the 3D-printer has to be flushed, in order to establish the shielding gas atmosphere. To this end a high nitrogen flow of 60 to 90 liters per minute is necessary. Next, during the printing process itself, a small nitrogen flow of 3 to 10 liters per minute has to be supplied, for refreshing purposes and to compensate for leakage. One in every ten to twenty 3D-printers sold by SLM Solutions Group AG is equipped with such a nitrogen generator and involves a Bronkhorst mass flow controller. ■



Example of a ship's screw



Example of a dental prosthese

Recommended Products



MASS-STREAM D-6300 Series

The digital MASS-STREAM series D-6300 operates on the through-flow measurement principle. Following the constant temperature anemometer principle. It is characterized by significant improvements and operated with a digital pc-board with all functions for accurate flow measurement and control. These instruments have IP65 protection as a standard.

- ◆ Usable for virtually every kind of gas
- ◆ Compact and robust IP65 design
- ◆ Very low pressure drop
- ◆ Measurement without moving parts
- ◆ Optional with integrated TFT display
- ◆ Maintenance-free
- ◆ Body material in aluminium or stainless steel

Contact information



3D printing of
metal products
A067-CM04-0117A

CM: Chemical, Metal and Glass
04: Iron, Steel and Metal Industry

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