

APPLICATION NOTE A067-CM04 - 3D PRINTING OF METAL PRODUCTS

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3D PRINTING OF METAL PRODUCTS

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.

Bronkhorst was able to help a machine builder, who makes 3D-printing machines that print metal parts out of steel, aluminium or titanium powder using selective laser melting, with a suitable system to generate nitrogen shielding gas. 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.



3D printing

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 aluminium.

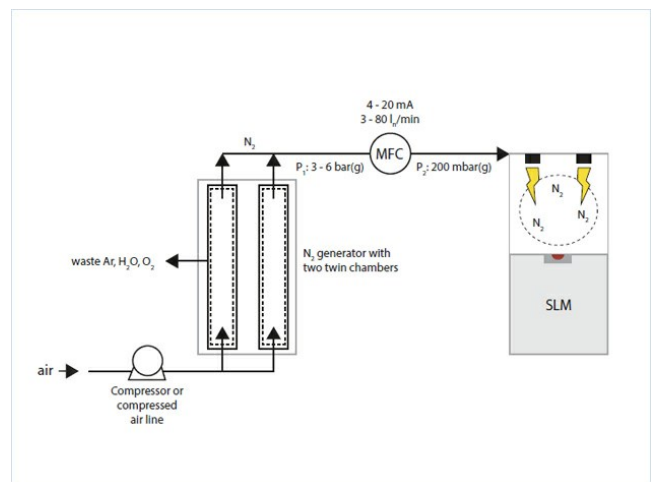
Important topics

- Reliable functioning of mass flow controller for N₂ supply
- Repeatability is more important than accuracy

Process solution

When end users establish a nitrogen atmosphere from a nitrogen generator, 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 can be 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 cooling purposes and to compensate for leakage.



Flow scheme

Recommended Products



MASS-STREAM D-6341 MFC

Min. flow 0,14...7 l/min
Max. flow 1...50 l/min
Pressure rating up to 20 bar
Rugged sensor and housing (IP65)
Optional integrated TFT display



MASS-STREAM D-6361/002BI MFC

Min. flow 0,4...20 l/min
Max. flow 4...200 l/min
Pressure rating up to 20 bar
Rugged sensor and housing (IP65)
Optional integrated TFT display



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