

Powder metallurgy



Facts & figures:

The European Market for powder metallurgy products alone has an annual turnover of over Six Billion Euros, with annual worldwide metal powder production exceeding one million tonnes.



Powder metallurgy in general

History:

Powder metallurgy was practiced long before ancient artisans learned to melt and cast iron. Egyptians made iron tools using Powder metallurgy (PM) techniques from at least 3000 B.C. Ancient Inca Indians made jewelry and artifacts from precious metal powders. The first modern PM product was the tungsten filament for electric light bulbs developed in the early 1900's. This was followed by tungsten carbide cutting tool materials in the 1930's, automobile parts in the 60's and 70's, aircraft turbine engine parts in the 80's and parts made by powder forging (P/F), metal injection

molding (MIM), warm compacting in the 90's, and nanotechnology in the new decade.

Process:

The basic powder metallurgy process uses pressure and heat to form precision metal parts and shapes. Powder is squeezed (at room temperature) with up to 50 tons per square inch into an engineered shape like a gear. Think of 50 compact cars stacked vertically and you have the pressure it takes to press the powder automatically in a mechanical or hydraulic compacting press. After the mass of powder is squeezed into a shape and ejected from the

press, it is fed slowly through a special high-temperature controlled atmosphere furnace to bond the particles together. They are metallurgically fused without melting, a phenomenon called "sintering". Other processes are also used to consolidate powders into finished shapes such as cold or hot isostatic pressing, direct powder rolling, forging, injection molding and gravity sintering. In contrast to other metal forming techniques, PM parts are shaped directly from powders while castings are typically formed from liquid metal or brought in shape by machining.

Discussed in this edition:

- Powder metallurgy in general **1**
- Why the need to measure humidity? **1**
- What solution can Rotronic offer? **2**
- Rotronic products **2**
- Customer benefits **2**

Why the need to measure humidity?

The biggest advantages of the sintering process is that an extrem fine grid with an excellent distribution of the elements can be achieved. Therefore the properties of the product is homogen and no weak spots are present.

Further more, large series of pieces with narrow tolerances can be produced and don't have to be machined afterwards.

Unfortunately the storage of the metal powders, especially the powders for stainless products require tight storage conditions. Due to the huge surface of powders, the metal powder is more likely to interact with oxygen and quickly starts to corrode, respectively to change its properties.

In order to maintain the highest quality for the final product, it is crucial that the powder

maintains its specific properties until it is sintered together.

For that reason the powder is kept in steel tanks which are flooded with nitrogen. In order to check that there are no leakages in the tanks or pipes, the humidity of the permanent flowing nitrogen is checked with a humidity probe or even better a low dew point probe since the gas is typically very dry.

What solution can Rotronic offer?

The heart of the latest humidity measurement products are the Rotronic capacitive humidity sensor, HygroMer IN-1, respectively the low dew point sensor HygroMer LDP-1. Both sen-

sors, with the best long term stability on the market are ideal for the monitoring the storage of metal powder.



All products with this logo contain an AirChip3000.

AirChip3000 advantages:

- *Relative humidity, temperature and dew point outputs*
- *Can store 2'000 points*
- *Sensor self-test function*



HF 5 Wall mount transmitter in combination with:

Rotronic products:

Humidity and Low Dew Point Probe:

- **HC2-LDP**
-40...85 °C,
-70...85 °C Td
Ø G12 Thread
± 2K Td (-50...20°C Td)
- **HC2-IC402**
-100...200 °C,
0...100 %rh,
Ø15 mm
±0.8 %rh and ±0.1K...
- **HC2-IC402-A**
-100...200 °C,
0...100 %rh,
Ø15/25 mm,
±0.8 %rh and ±0.1 K...

Transmitters:

- **HF5 series**
For interchangeable probes, Various analogue and digital outputs, Display, All psychrometric calculations available...
- **HF7 series**
Stainless steel probe, -100...200 °C, 0...100 %rh 3/4 wire configuration, Various analogue outputs, Display...
- **HF8 series**
For 2 interchangeable probes, Various analogue and digital outputs, Display, relay outputs. All psychrometric calculations available...

Data loggers:

- **HL-NT range** *(not compatible with HC2-LDP)*
For interchangeable probes (up to 7 probes with docking station)
32 MB flash card
Large LC display,
Conforms to FDA 21 CFR Part 11 and GAMP4...
- **LOG-HC2-RS** *(not compatible with HC2-LDP)*
Wireless logger with single interchangeable probe input.
Stores up to 500,000 data points. 6 Year battery lifetime
Range 100 m free field
Measurements: probe specific
Conforms to FDA 21 CFR Part 11 and GAMP4...

Customer benefits:

Accuracy:

Choosing Rotronic products gives you the best accuracy on the market.

Precise humidity or dew point measurement enables the ideal storage conditions for the powder metal and therefore ensure a top quality of the final product.

Communication:

Networking with Rotronic is an easy affair! With the wide range of communication

interfaces available, from conventional analogue output signals to USB, RS-485, Wireless and Ethernet RJ-45, Rotronic can provide the required interface to your control unit, or any third party monitoring system.

Long term stability:

With long term sensor stability of under 1 %rh per year (depending on the environment), Rotronic offers the possibility to "plug & play": install the device and leave

it. We would recommend regular spot checks between multi-point calibrations.

Calibration:

Rotronic offers a factory calibration certificate, and SCS certificate if required. The portable HygroGen temperature & humidity calibrator as well as unsaturated humidity salts are also available for on-site calibration.



LDP Low Dew Point Probe

HC2-IM402 Probe