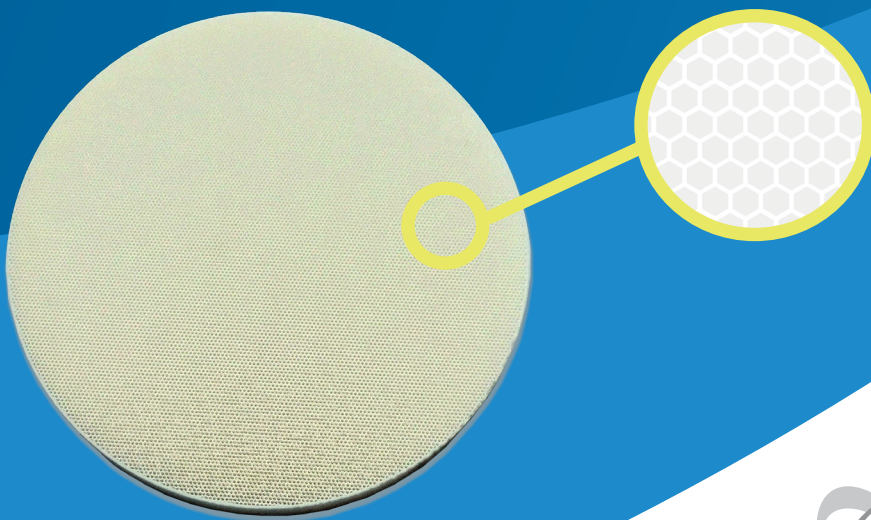


Ceramics

Micro precise technical ceramic
parts manufacturing
at industrial scale



exentis
group
Industrialized
Additive Manufacturing



Content

Intro & Materials	3
Application Examples	4
Advantages of Additive Screen Printing	5
Technical specifications	6
Print process and production systems	7

Mico precision ceramics manufacturing at industrial scale

Innovative, precise and efficient

The unique Exentis technology is setting new standards for additive manufacturing. It enables large-scale production of millions of parts with geometries that were previously impossible to realize.

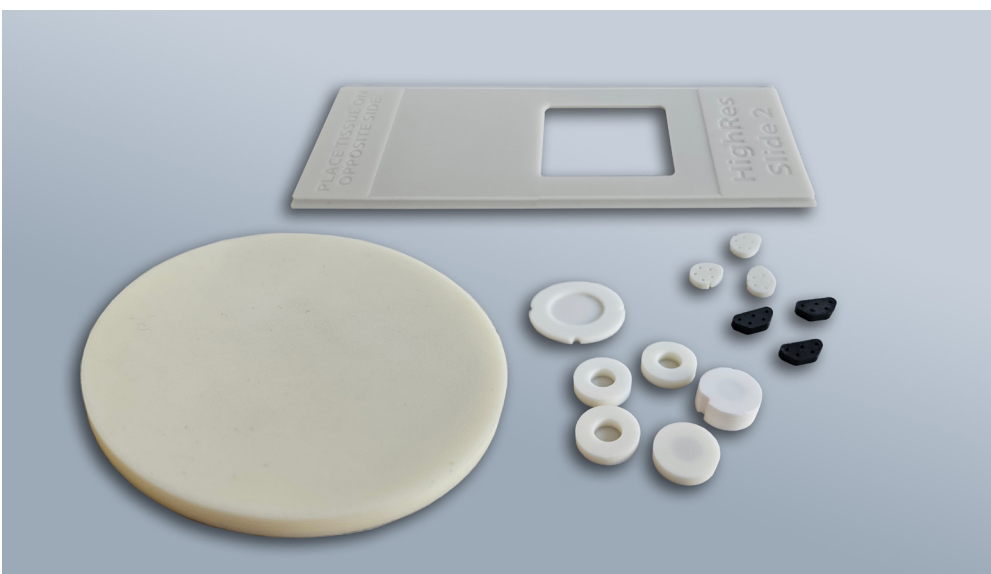
This includes for example very small parts with ultra-fine structures as small as 125 µm for channel width, which can be incorporated in larger components with a diameter of up to 400 mm. An example: It is possible to integrate functions such as cooling structures. A wide range of materials that are available in powder form, like ceramics, metals, polymers and biomaterials, can be processed.

Available ceramic materials

Typical technical ceramics that can be processed easily by Additive Screen Printing:

- Aluminum oxide, Alumina / Al_2O_3
- Zirconium oxide, Zirconia / ZrO_2
- Silicon carbide / SiC
- Aluminum nitride / AlN
- Barium titanate / BaTiO_3

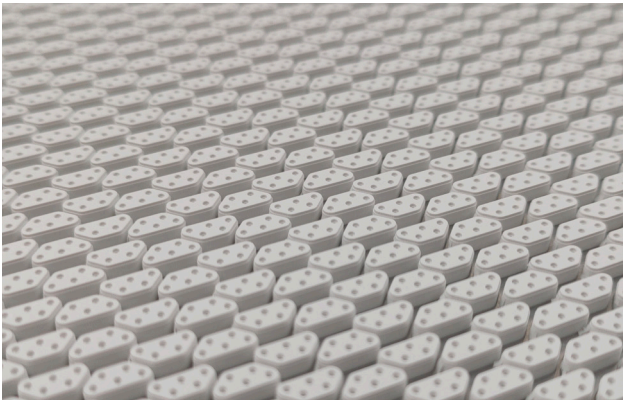
Furthermore, the technology allows processing of customized materials. The printing process is based on pastes developed in-house by Exentis material specialists, enabling us to meet your specific requirements.



Additive Screen Printing enables the finest structures without post-processing. It allows to process a wide range of materials, such as ceramics, metals, polymers, biomaterials and many more.

Application examples ceramic materials

MedTech: Ceramic wireguides
More cost-efficient production, no need for tooling or post-processing



Aluminum oxide wireguides for heart pacemakers



Application / the challenge:

Ceramic wireguides with a high hermetic seal are parts of heart pacemakers. Expensive tool molds were needed to manufacture the ceramic parts when using traditional technologies. Furthermore, the parts required post-processing to meet quality standards.

Solution:

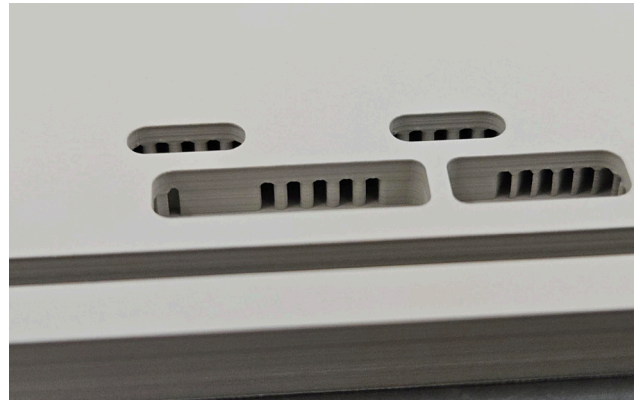
Using Exentis technology, the customer can save costs as no expensive tools and no post-processing are required. The additive series manufacturing meets the MedTech quality standard and is therefore the more cost-efficient process for the customer.

Part size: 6.2 x 3 x 1.4 mm

Production capacity: 84'000 pcs per 8h shift

Advantage: Lower costs, no post-processing

Thermal Management
Improved cooling structures and cost benefits



Printed channels in a cooling part



Application / the challenge:

Manufacturing aluminum nitride with traditional technologies is expensive. Additionally, the design of channels within parts is limited.

Solution:

With Exentis Additive Screen Printing, the customer gained the ability to optimize parts for performance in a way that was not possible before. Additive Screen Printing delivers full design freedom in the X and Y axes. Furthermore, thinner walls up to 75 µm can be manufactured. Combined with more, denser channels, the performance of the cooling parts was improved significantly at attractive manufacturing costs.

Part height: 2.5 mm

Parts per screen: 15

Advantage: Attractive costs, design freedom

Advantages of the Additive Screen Printing Technology

Exentis 3D technology permits solutions that were impossible in the past. Take advantage of these benefits for ceramics manufacturing:



Large-scale industrial manufacturing

5 million applications per year on one production system for ceramics, metals, polymers, with a high building rate of up to 10,000 cm³/h



Free choice of materials

Ceramics, metals, polymers, organic materials, biomaterials. Several materials in one component.



Ultra-fine structures

Channel width from 125 µm, wall thicknesses from 75 µm, surface quality with roughness levels 2 µm



Optimized part geometries

Hollow structures to reduce weight, for parts with integrated functions, e.g. cooling structures



Highly flexible production technology

One production system for processing all materials, outstanding processing capability for industrial manufacturing



Favorable cost/benefit ratio

Lowest production costs, no post-processing needed for components



Eco-friendly cold printing technology

Low energy consumption through cold printing technology, high material efficiency, only material needed for the component is processed

Technical specifications in detail

Smaller, flat parts in the millions

Parts with the dimensions mentioned in the table below represent the most optimal range for efficient manufacturing.

Production capacity: from 5'000 to more than 5 million parts per year on one production system, depending on part design, size, material and production system.



Additive Screen Printing is suitable for mass manufacturing in the millions, unlike most other additive manufacturing technologies. Image: ceramic sensors.

Part and printing process	
Base area	1 mm - 50 mm
Height	0,1 mm - 50 mm
Volume	> 5'000
Wall thickness	≥ 70 µm
Channel width	≥ Ø 125 µm
Surface quality, roughness	Ra ~ 2 µm
Tolerances	± 30 µm
Build rate	5'000 -10'000 cm ³ /h
Density green bodies	up to 70 vol %
Shrinkage at sintering	5 % - 20 %

Screens and pastes	
Particle size powder	1 µm - 50 µm (d50)
Solid contents of pastes	40 % - 60 vol%
Increment, layer thickness	5 bis 100 µm (screens) > 100 µm (stencils)
Screen mesh	20 µm - 500 µm
Screen wire diameter	≥ 10 µm
Screen costs	500 - 2'000 EUR

Overhangs 0.5 mm	Wall thickness 70 µm	Aspect ratio wall widths < 1 mm, 4:1 wall widths > 1 mm, 8:1	Aperture size 125 µm	Channel width 125 µm	Sealed cavities
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Technology and production systems

The printing process

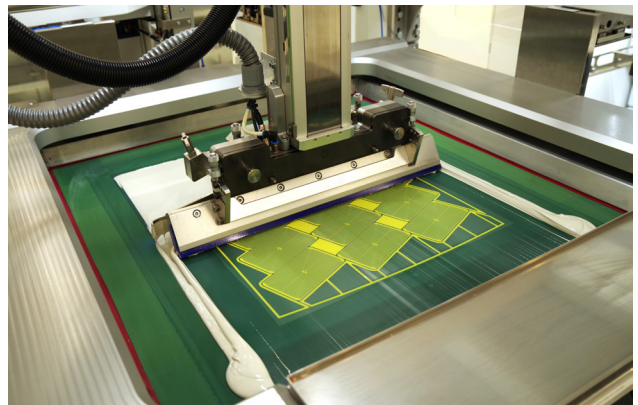
Exentis 3D technology is based on the traditional, high-precision screen printing process, which Exentis has extended to the third dimension. When printing, the material in paste form is pressed through a screen on a work-piece carrier, layer by layer, until the parts reach their final height. The screens determine the parts' shape.

The printing process is fully automatic with a cycle time of only two to eight seconds. Depending on the number of parts on a work-piece carrier, series with millions of parts can be printed on just one production system. "Retooling" from one component to another takes just a few minutes.

Screens and material pastes

We manufacture the screens within 48 hours. Elaborate and expensive tools and molds, like those used for conventional processes, are not required.

A wide range of material which is available in powder form can be processed into a printable paste: ceramics, metals, polymers, customized materials, biomaterials and many more. The high expertise of our material experts allows us to develop customized pastes.



Cooling parts during the printing process

Exentis 3D Technology Platform

Our production systems are configurable to your requirements, supporting both medium- and high-volume production. Each system can be configured for clean-room manufacturing if needed.



Additive Screen Printing

Ceramic Materials Whitepaper

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