

## High Performance Metal Solutions

# 3D Screen Printing Building on our History

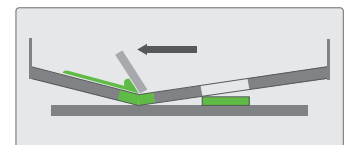
Combining 100 years of experience in refractory metals with competency in 3D printing technologies, H.C. Starck Solutions provides cutting edge knowledge in the quickly evolving field of additive manufacturing (AM).

H.C. Starck Solutions' 3D Screen Printing method for AM of refractory metals uses a metal printing paste that is applied in vertical layers to create the desired geometry. The technology is successfully utilized in producing complex grid structures.

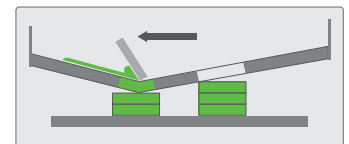
The process enables us to print very small feature sizes with tight tolerances. It utilizes traditional powders resulting in exceptional customer value.

Proprietary post-print processing is typically required as a finishing step and allows us to achieve properties that exceed traditional powder metallurgy specifications. This enables our customers to take advantage of the benefits of AM without sacrificing on material characteristics.

### Processing Steps



Printing Layer 1



Printing Layer 3



Printing Complete



Post-Print Processing



High Performance Metal Solutions

## H.C. Starck Solutions – Your Partner for AM

H.C. Starck Solutions works closely with its customers to select the correct feedstock and method that will provide the most value to any given application. 3D Screen printing provides high resolution with excellent dimensional control while offering exceptional customer value.

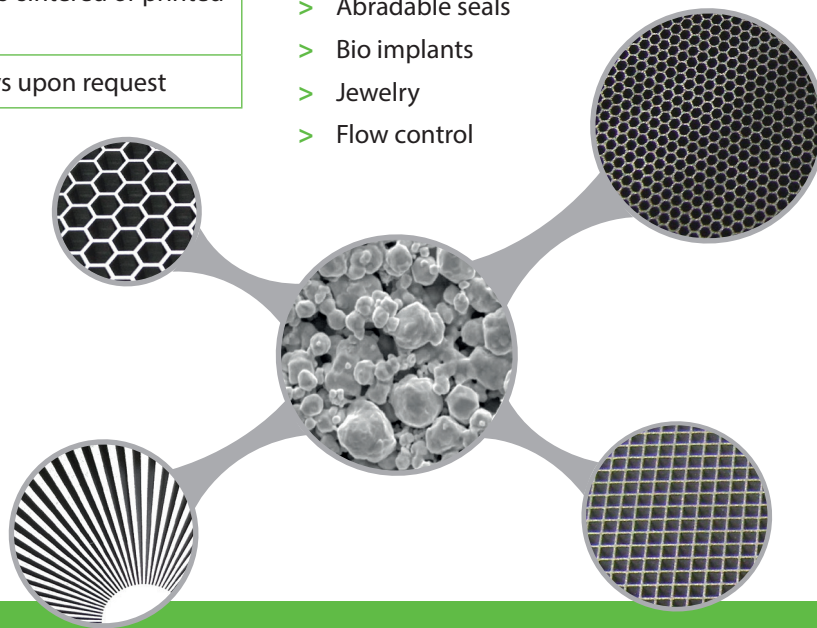
Screen Printing Process Capabilities	
<b>Overall Print Size (H x W x L)</b>	100 x 220 x 270 mm
<b>Height Range</b>	0.1 – 100 mm
<b>Minimum Feature Size</b>	120 µm
<b>Typical Dimensional Tolerance</b>	± 1% with a minimum tolerance of ± 0.05 mm
<b>Density Range</b>	7 – 17 g/cc depending on material
<b>Current Materials</b>	Tungsten heavy alloy in as-sintered or printed + infiltrated condition
<b>Alternate Materials</b>	Fe, Co, and Ni-based alloys upon request

### Potential Applications

- > Collimators
- > Balance weights
- > Fuel cells
- > Catalyst substrates
- > Micromechanics
- > Heat exchangers
- > Thermal insulation
- > Abradable seals
- > Bio implants
- > Jewelry
- > Flow control

### What We Provide

- > Stencil design & layout optimization
- > Printing paste formulation & improvement
- > Printing services in custom materials
- > Proprietary post-print processing
- > Strategies to increase strength of the printed parts
- > Volumes from prototype range to production scale



DPAP 09/19

The conditions of your use and application of our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations, are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis at least must include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by H.C. Starck Solutions. All information is given without warranty or guarantee. It is expressly understood and agreed that the customer assumes and hereby expressly releases H.C. Starck Solutions from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance and information. Any statement or recommendation not contained herein is unauthorized and shall not bind H.C. Starck Solutions. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent. Properties of the products referred to herein shall as general rule not be classed as information on the properties of the item for sale. In case of order please refer to issue number of the respective product data sheet. All deliveries are based on the latest issue of the product data sheet and the latest version of our General Conditions of Sale and Delivery.

The values in this publication are typical values and do not constitute a specification.

For additional information please contact:

### USA

**H.C. Starck Inc.**  
21801 Tungsten Road  
Euclid, OH 44117-1117 USA  
T +1 216 692 3990  
F +1 216 692 0029

### Germany

**H.C. Starck Hermsdorf GmbH**  
Robert-Friese-Straße 4  
Hermsdorf, Germany 07629  
T +49 36601 922 0  
F +49 36601 922 111