

FRAUNHOFER IPK

EMIRIM Project

Additive Manufacturing to
produce functional surfaces

November, 2018

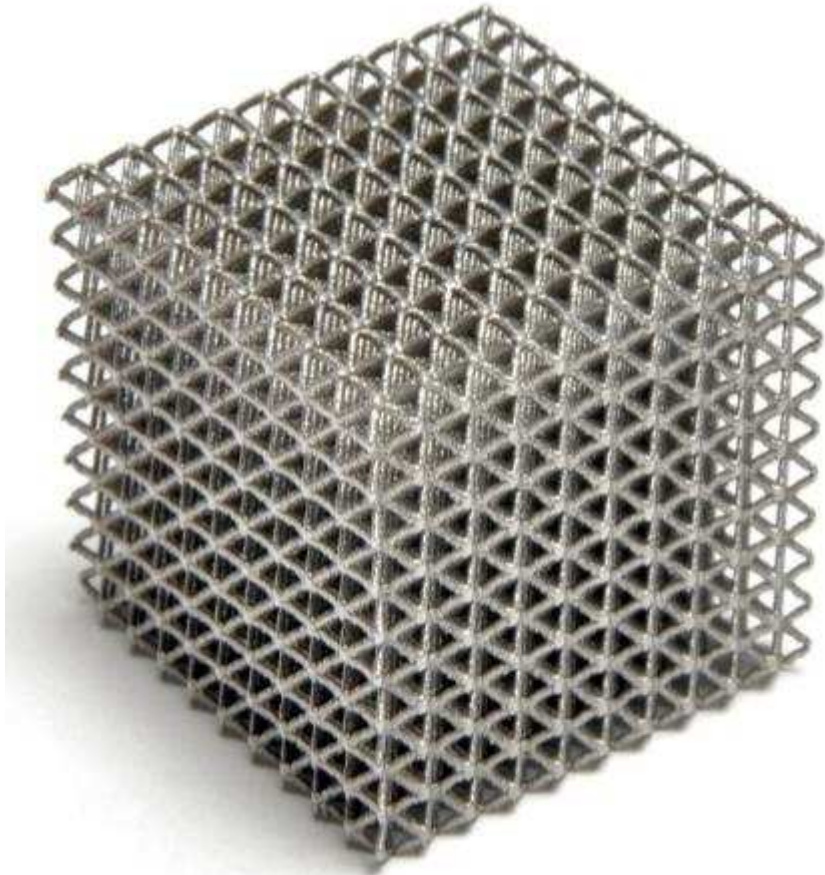
Fraunhofer-Institute for
Production Systems and Design
Technology IPK

Institute for Machine Tools and
Factory Management IWF,
Technische Universität Berlin



Additive Manufacturing to produce functional surfaces

AM General

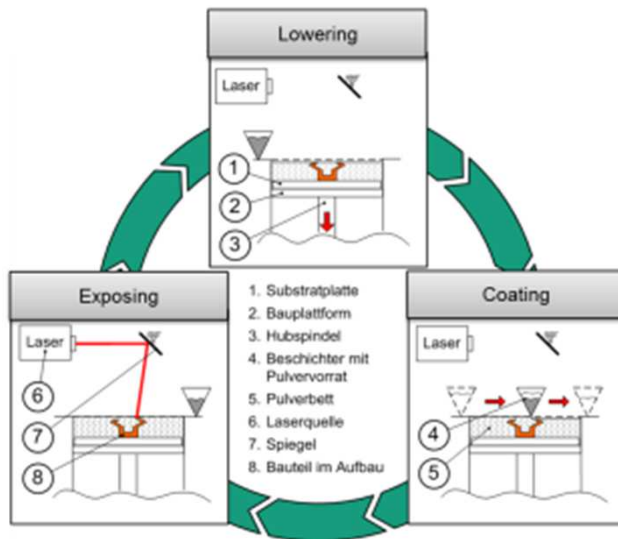


Metal Cube with 10x10x10 mm.
Mesh size is 1 mm.

- Tool-less production:
With Additive Manufacturing complex structures could be easily produced
- Direct manufacturing:
CAD data can be directly “converted” to product.
- Complex surface structuring possible.
Even porous surfaces.

Additive Manufacturing to produce functional surfaces

Laser Powder Bed Fusion method (L-PBF):



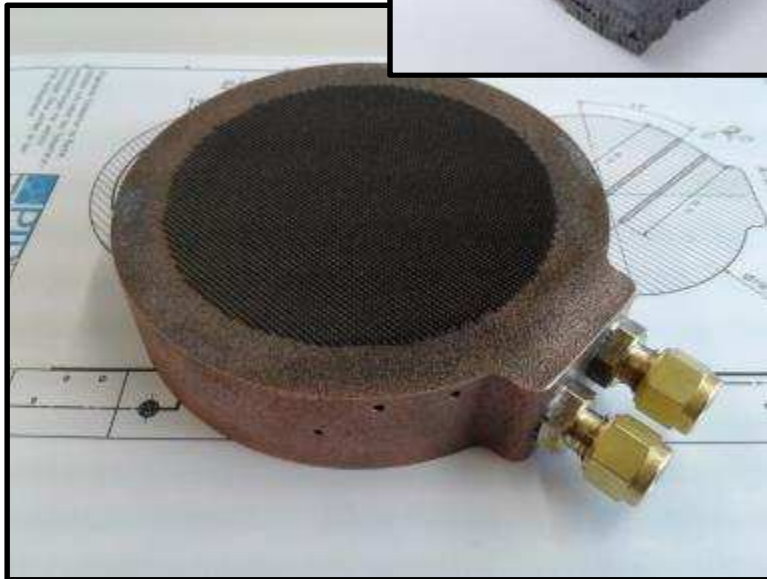
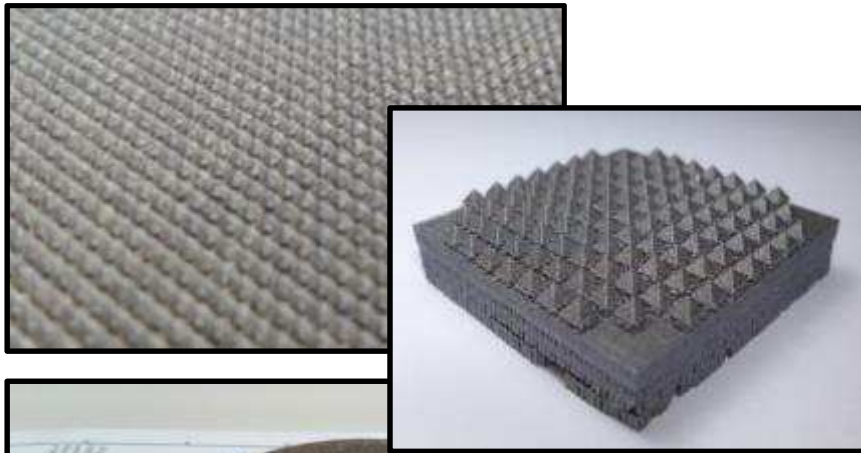
- Geometric accuracy about $\pm 0,2$ mm for metal. Depending on raw material size and Laser spot diameter (Molten bath dimensions)
- Material properties comparable to classical technologies like casting.
- All weldable materials possible.



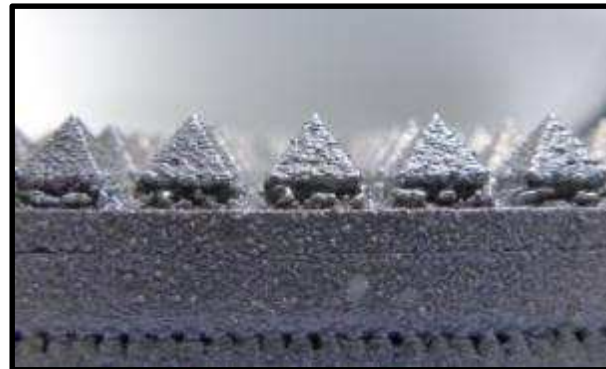
Additive Manufacturing to produce functional surfaces

#1 Periodic Structures

- Increase emissivity of surfaces by manufacturing periodic pyramid light traps
- Structure size of pyramid approx. 1 mm minimum. Easy scalability.
- Build complex parts like emitters and heat exchangers or optical devices

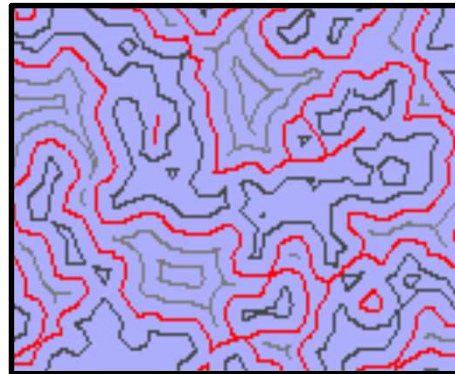
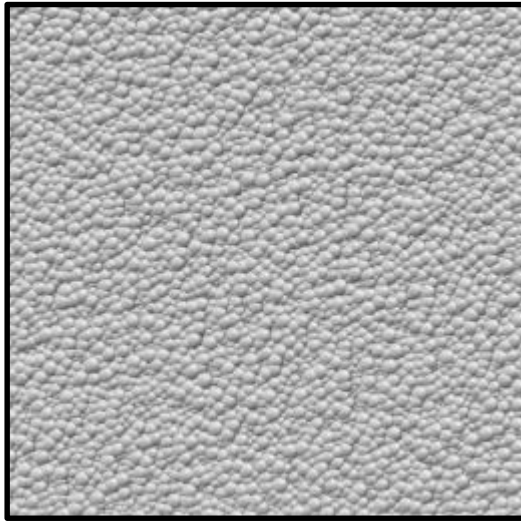


Additive Manufactured emitter
(CuCr1Zr) by PTB & IPK



Additive Manufacturing to produce functional surfaces

#2 Randomly generated Structures



CAD, Scanning vectors, Reality



- Apply via algorithm generated structure on part surfaces
- Challenge 1: Adapt surface laser parameters to geometric variations in algorithm
Not all is possible due to minimum size of molten bath
- Challenge 2: Taking “natural” roughness into account
→ Defined by powder particle size (approx. 50 μm)

Thank you very much for your attention!

Robert Kersting

Research Fellow Additive Technologies

Fraunhofer IPK | Pascalstraße 8–9 | 10587 Berlin

Fon: +49 30 / 3 90 06–355

Email: robert.kersting@ipk.fraunhofer.de

