This Quick Guide gives answers to

- What are the metal 3D printing technologies and what do they offer?
- Which 3D printing technology fits best for my application?
- What is the best way to select parts suited for production using metal AM technology?

From Zero to Hero
Insights into Metal 3D Printing

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Executive summary

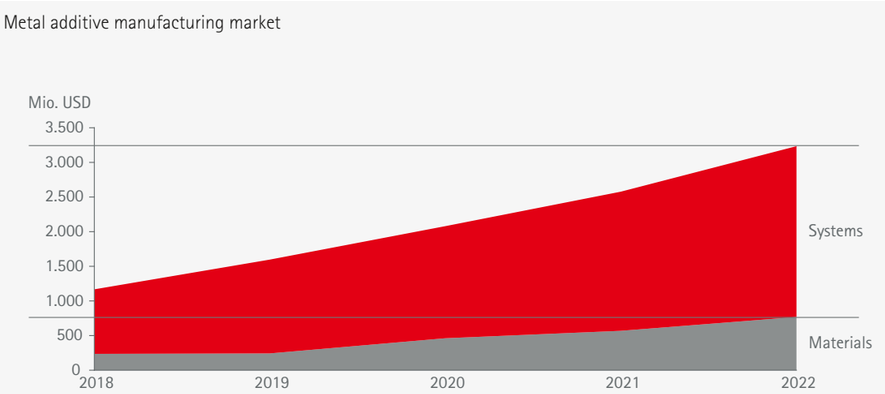
Practically unlimited opportunities: Metal additive manufacturing (AM) technologies offer maximum freedom of design and production meaning a paradigm change to design-driven manufacturing possible anywhere in the world. In recent years industrial 3D printing has shifted from prototyping to production enabling not only innovative part designs but also innovative business models. Both can change an entire industry.
This quick guide provides an overview of the different metal AM technologies, their strengths and weaknesses plus insights on their suitability for production.

Welcome
to the World of Opportunities

Conventional metal manufacturing technologies either form (e.g. casting) or remove (e.g. milling) material. They have been around for decades, are well established in today's manufacturing world and have their limitations which impact the design of parts.
Additive manufacturing technologies add material layer-by-layer exactly where needed and as much as required. This opens up a world of opportunities for part design as there are practically no limitations to the imagination.

Metal 3D printing has been around for about 25 years. As with many disruptive technologies, it has followed the Gartner Hype Cycle and is becoming a production technology. The metal AM market has been growing exponentially in the past few years and is expected to triple by 2022.

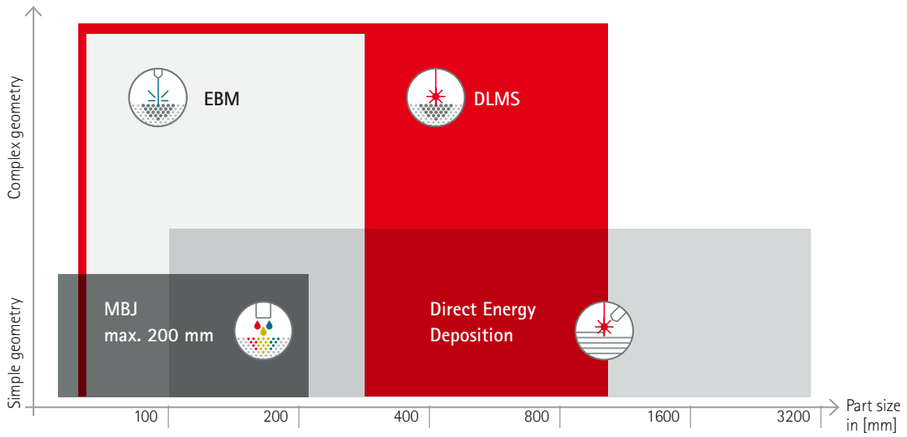
The metal additive manufacturing market is expected to more almost triple within the next 5 years



Source: SmarTech

Overview of Metal AM Technologies

Comparison Metal Additive Manufacturing Technologies



... DMLS with the largest scope of applications

Metal

MBJ

Metal Binder Jetting

Main advantage
Fast green part production process

Main downside
Complex parts with variing structures not possible, oven process for sintering needed

Productivity ↗
Part Complexity →
Part Properties
↘ Density ↘ Mech. Properties → Surface

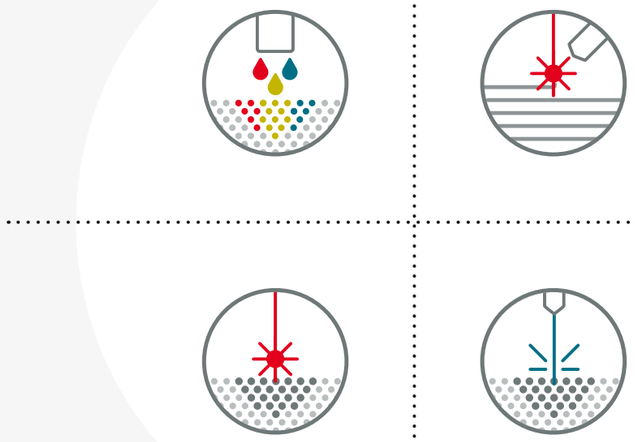
DED

Direct Energy Deposition

Main advantage
High productivity; for large parts, less machine invest

Main downside
Less accuracy and part surface quality

Productivity ↑
Part Complexity ↓
Part Properties
↑ Density ↑ Mech. Properties ↓ Surface



DMLS

Main advantage
Reproducible defined part properties

Main downside
High(er) machine invest

Productivity ↗
Part Complexity ↑
Part Properties
↑ Density ↑ Mech. Properties → Surface

EBM

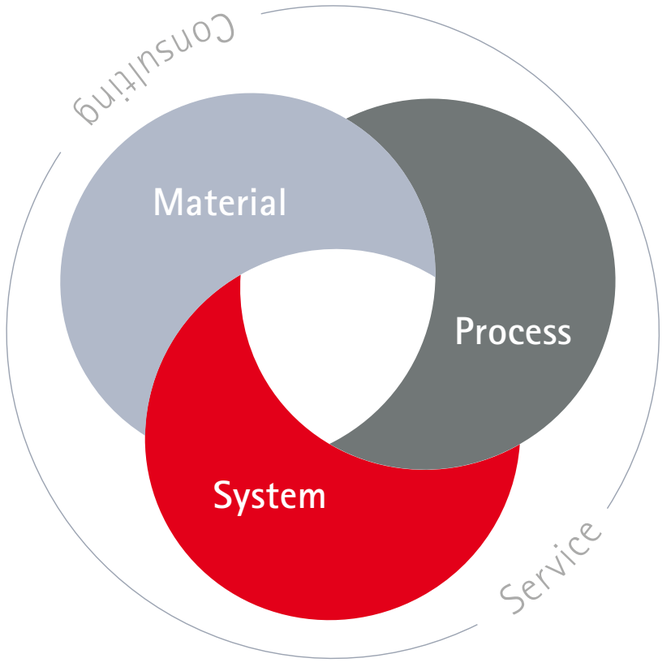
Electron Beam

Main advantage
Reproducible defined part properties

Main downside
High(er) machine invest, expensive evacuating of process chamber needed

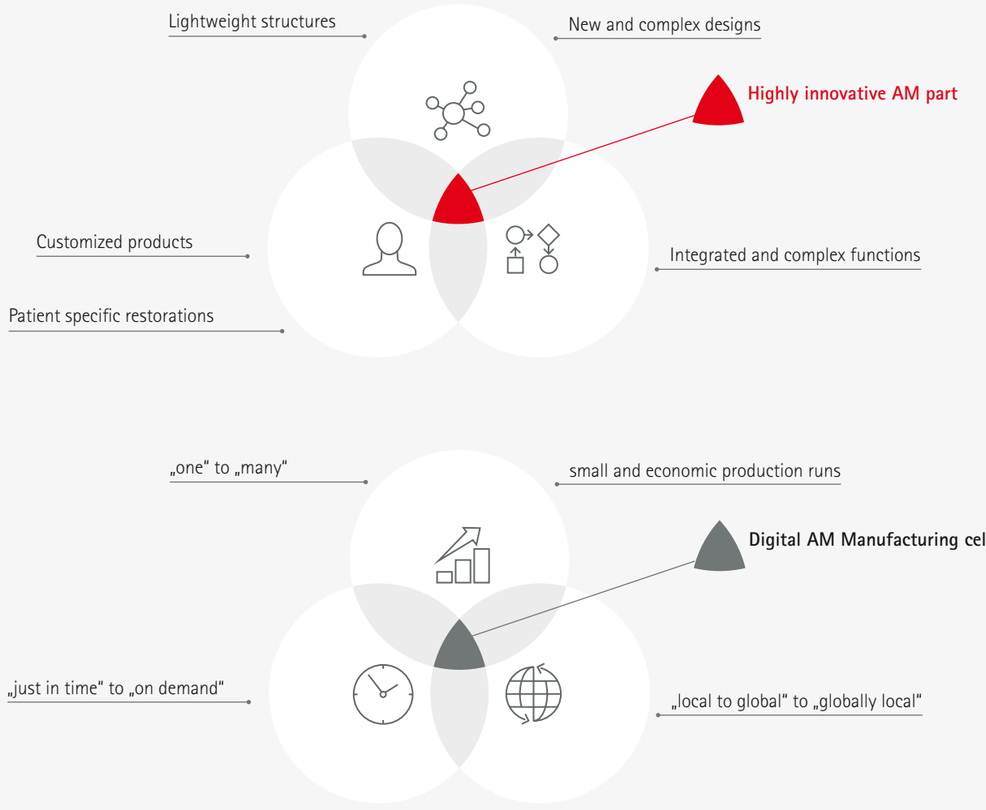
Productivity ↗
Part Complexity ↗
Part Properties
↑ Density ↑ Mech. Properties ↘ Surface

Metal 3D Printing in Production



Consistent part quality – the core requirement for production – is determined mainly by the interaction between the material, the system and the process. These three cornerstones, each subjected to extensive quality control by the supplier, must be aligned to meet the requirements of the respective application.

The flexibility of metal 3D printing technology with its practically unlimited opportunities can be overwhelming. Thus, a structured approach is needed to successfully implement this technology in production. Its main technical characteristics guide the way to identify the applications that are the best fit. There will be challenges along the way but they can be overcome with the support of EOS' Additive Minds team.



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Sebastian has a Master of Science degree in Industrial Engineering from the Ernst-Abbe-Hochschule Jena, University of Applied Sciences. He has over 8 years of experience in technical product management, specifically laser-scanner-optics, before joining EOS about a year ago.
Currently he is focusing on the development of the new EOS M 300 Series and the Metals Systems portfolio.

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