



Webinar SIG 3DP
March 28th, 2024

Program:

- Welcome by Harry Kleijnen, chairman 3DP-cluster
- State of the Additive Manufacturing industry; 'Where are we?' by Daniel Hoogstraate, Account Manager Additive Manufacturing Services for the Netherlands at Materialise
- Introduction to most commonly used AM technologies: SLA, SLS, MJF, FDM & SLM by Rob van Loon, Manager Additive Manufacturing at KMWE Additive & Reuse
- When to use AM or not?
- Serial production in aerospace, actual parts
- Pitfalls when exploring appropriate applications for AM

NAG SIG 3D introduction

Vision:

Advancing the Dutch aerospace industry competitiveness through cutting edge **additive** technologies, fostering innovations and ensuring sustainable growth

Highlighting the opportunities of Additive Manufacturing:

- Freedom of Design allowing complicated geometries without compromising structural integrity
- Potential of cost reduction by waste reduction, less energy intensive processes and light weight components
- Time to market reduction. AM enables fast design iterations, optimized fine tuning to meet stringent performance and safety requirements
- Supply chain efficiency, on-demand production and reducing the need for extensive warehousing and long lead times

Pushing Performance and Boundaries.

Traditional manufacturing constraints often hinder innovation. AM technology opens new opportunities to push performance and expanding iterative thinking

Industrialization of Additive Manufacturing.

AM has matured substantially, from prototyping, tooling to nowadays series production including quality, safety and certification of AM produced parts

Collaboration.

Emphasizing partnerships between the Dutch AM ecosystem, aerospace industry players, academia and regulatory bodies.

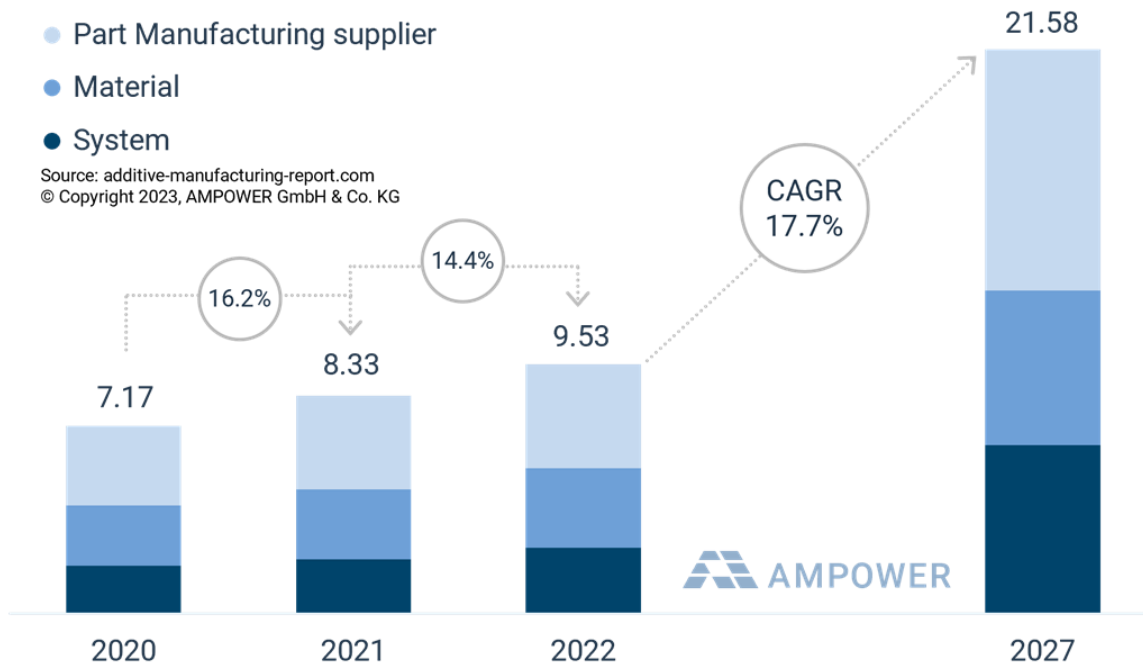
- ✓ Intro AM-Industry
- ✓ Cases AM in Aerospace
- ✓ Techniques in AM
- ✓ Wrap-up



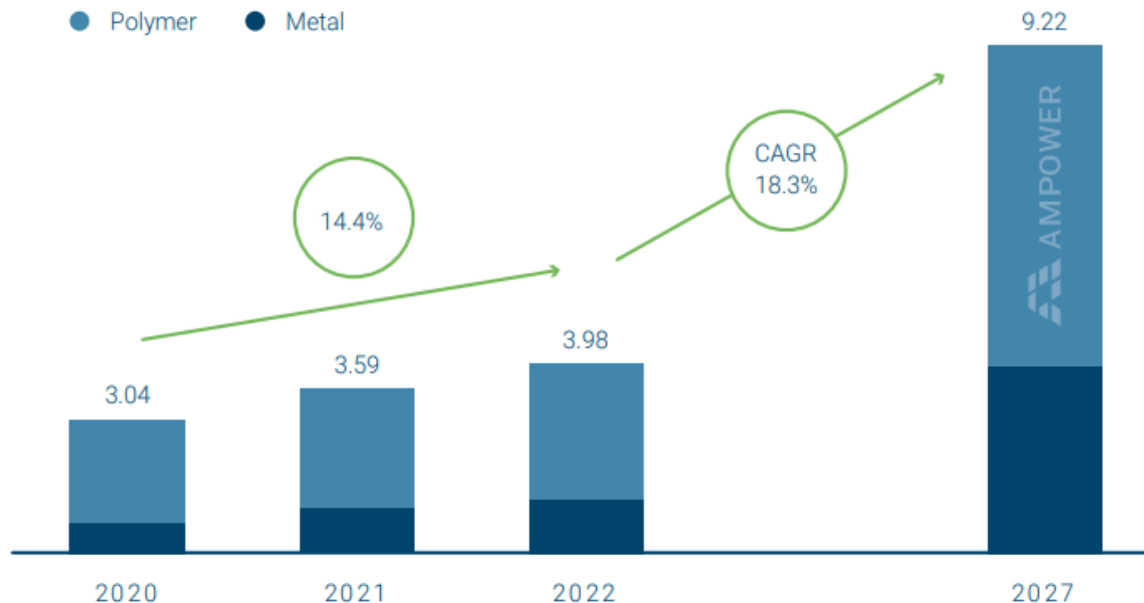
Global metal and polymer Additive Manufacturing market 2020 to 2022 and supplier forecast 2027 [EUR billion]

- Part Manufacturing supplier
- Material
- System

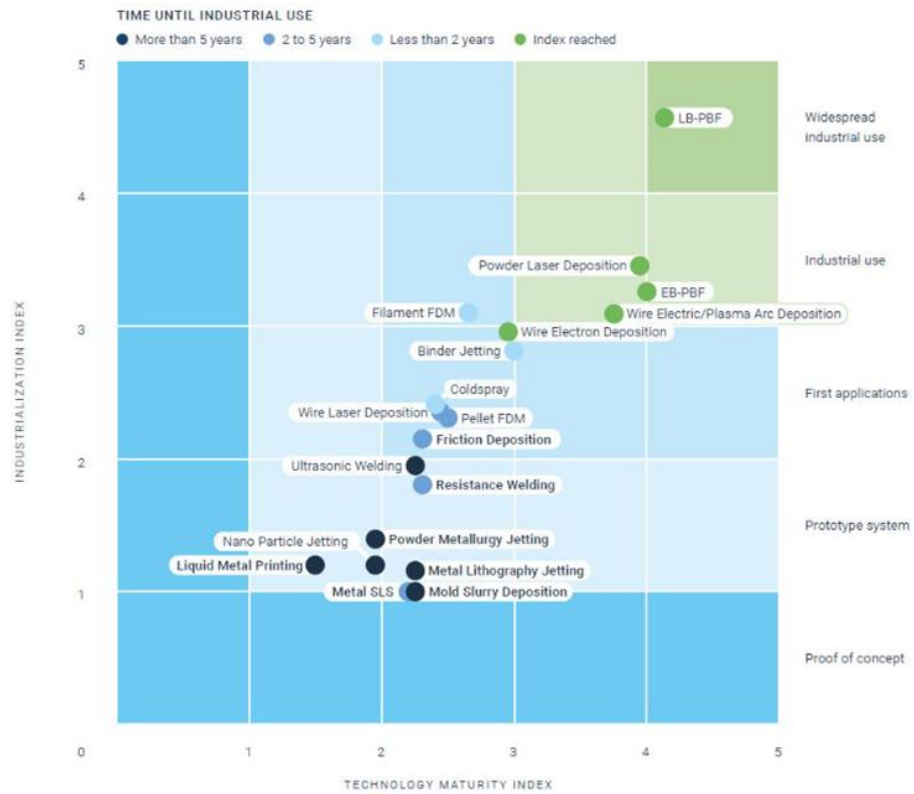
Source: additive-manufacturing-report.com
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Additive Manufacturing part manufacturing supplier market [EUR billion]



Source: additive-manufacturing-report.com
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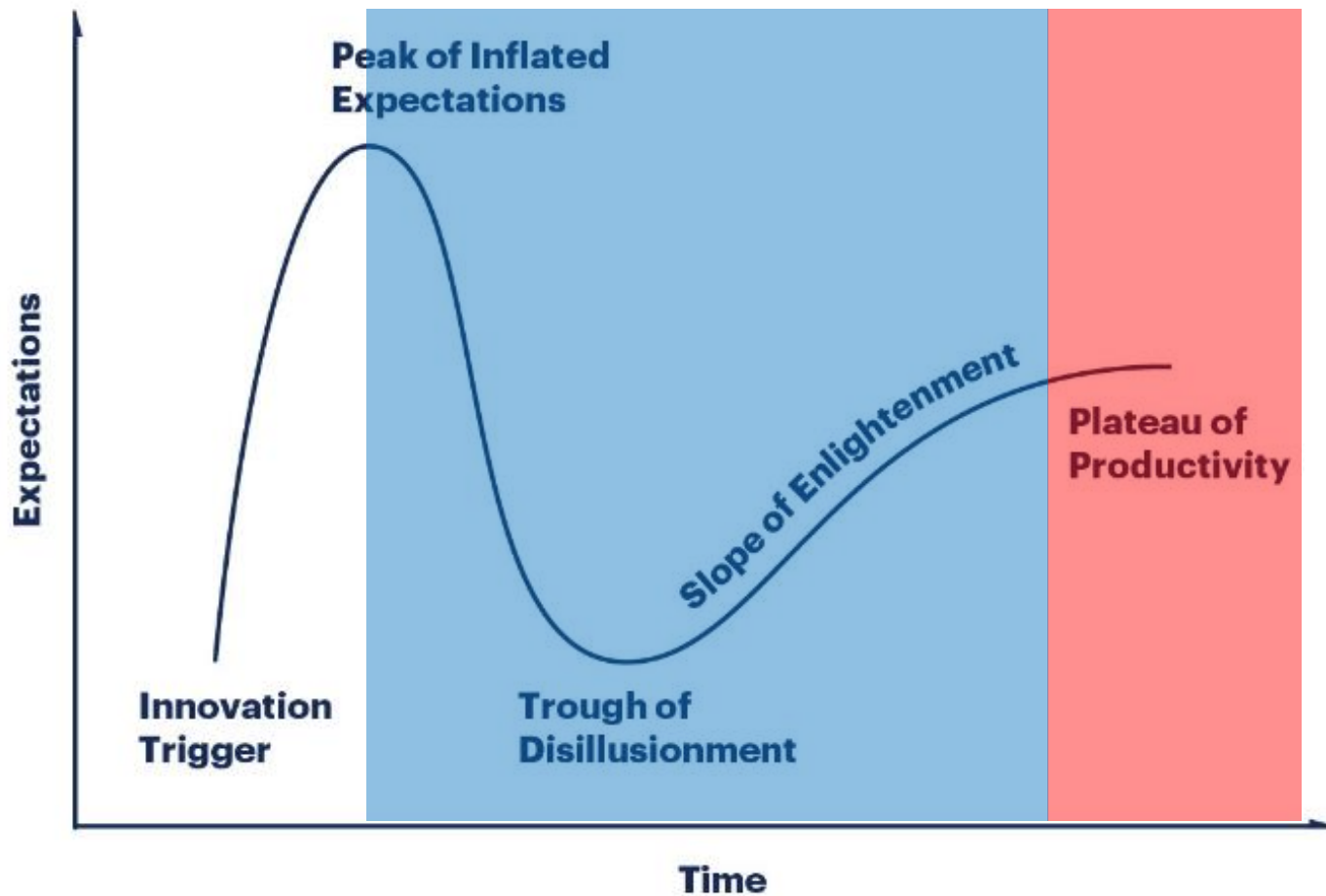


Good and bad news about AM-adoption

80% of manufacturers are stuck in Rapid Prototyping.

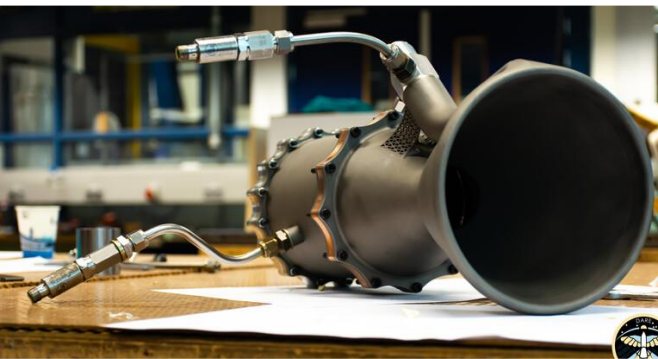
90% of manufacturers are eager to adopt Additive Manufacturing as a manufacturing technology.





HINDERPALEN VOOR HET TOEPASSEN VAN 3D-PRINTING

Gebrek aan interne expertise en know-how rond AM	45%
Investeringskost	40%
Gebrek aan een business case rond AM of die is niet duidelijk	34%
Huidige technologische beperkingen van AM: productkwaliteit	23%
Huidige technologische beperkingen van AM: productiesnelheid	18%
Gebrek aan certificering en normering	18%
Onduidelijkheid over certificering en normering	18%
Weerstand tegen verandering en innovatie binnen het bedrijf	15%
Huidige technologische beperkingen van AM: (multi-)materialen	14%
Overige:	11%
Huidige technologische beperkingen van AM: productgrootte	9%
Moeilijke integratie in de huidige operationele werking van uw bedrijf	5%
Intellectuele eigendomskwesaties	3%



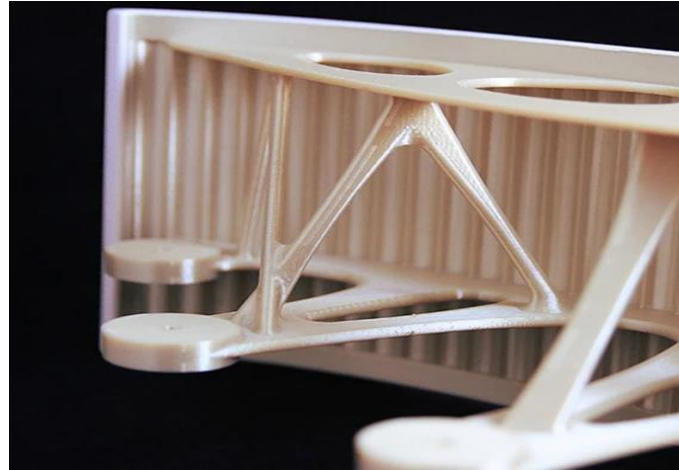
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328 Support Services GmbH/Deutsche Aircraft GmbH



AIRBUS

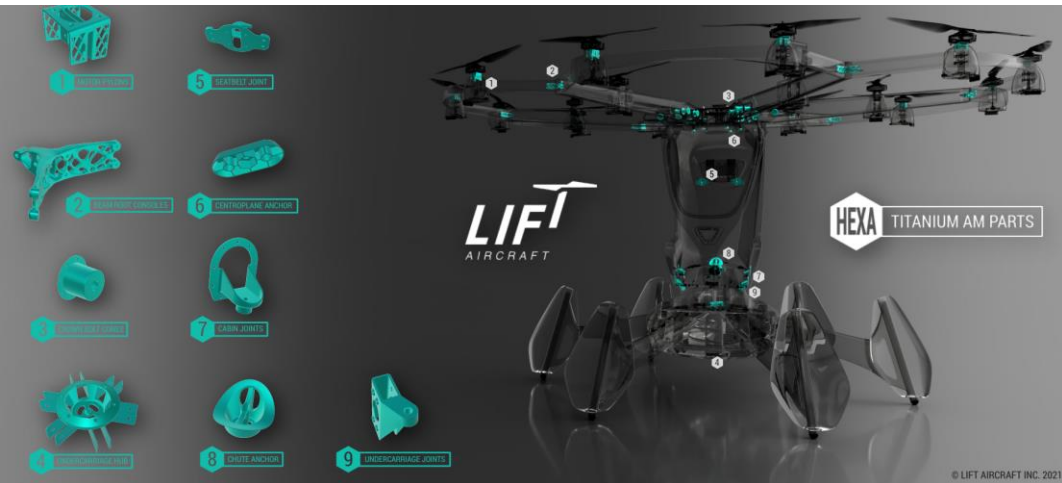


materialise
innovators you can count on



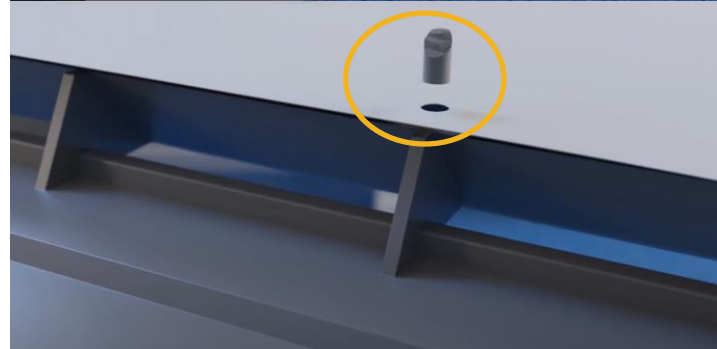
EASA
European Aviation Safety Agency







[expleo]





Customer Request

- Constantly recurring small breakages on Dado Panel causes intensive repair or substitution

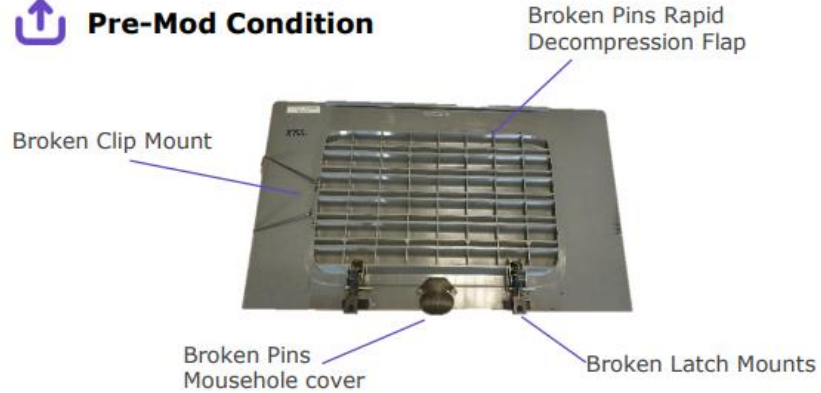


Customer Pain points

- Frequent breakage leading to cost for replacement or repair



Pre-Mod Condition



Concepts

- Create a set of parts solving each breakage problem as repair kit
- Kit easy to be ordered and handled covering complete repair of one Dado Panel

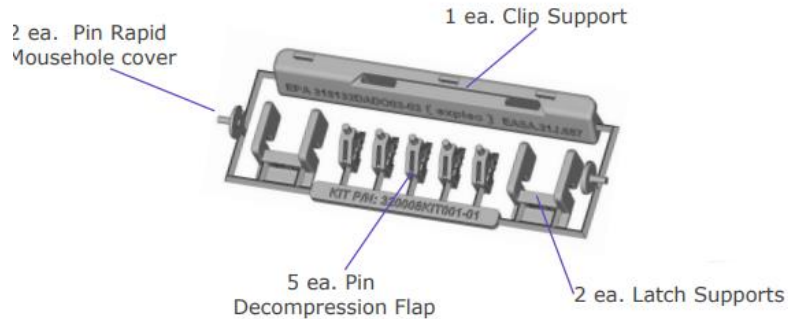


Improvements

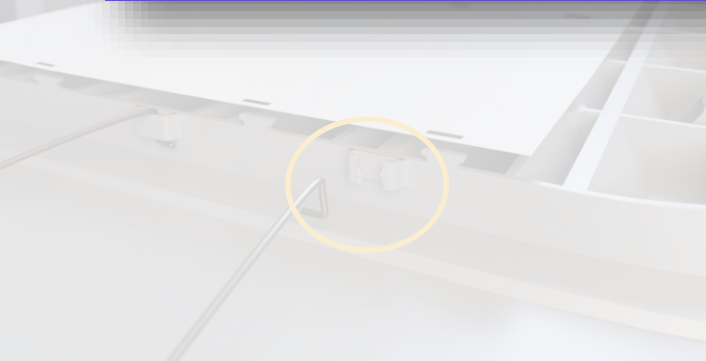
- Save costs due to repair instead of complete substitution
- Environmentally friendly

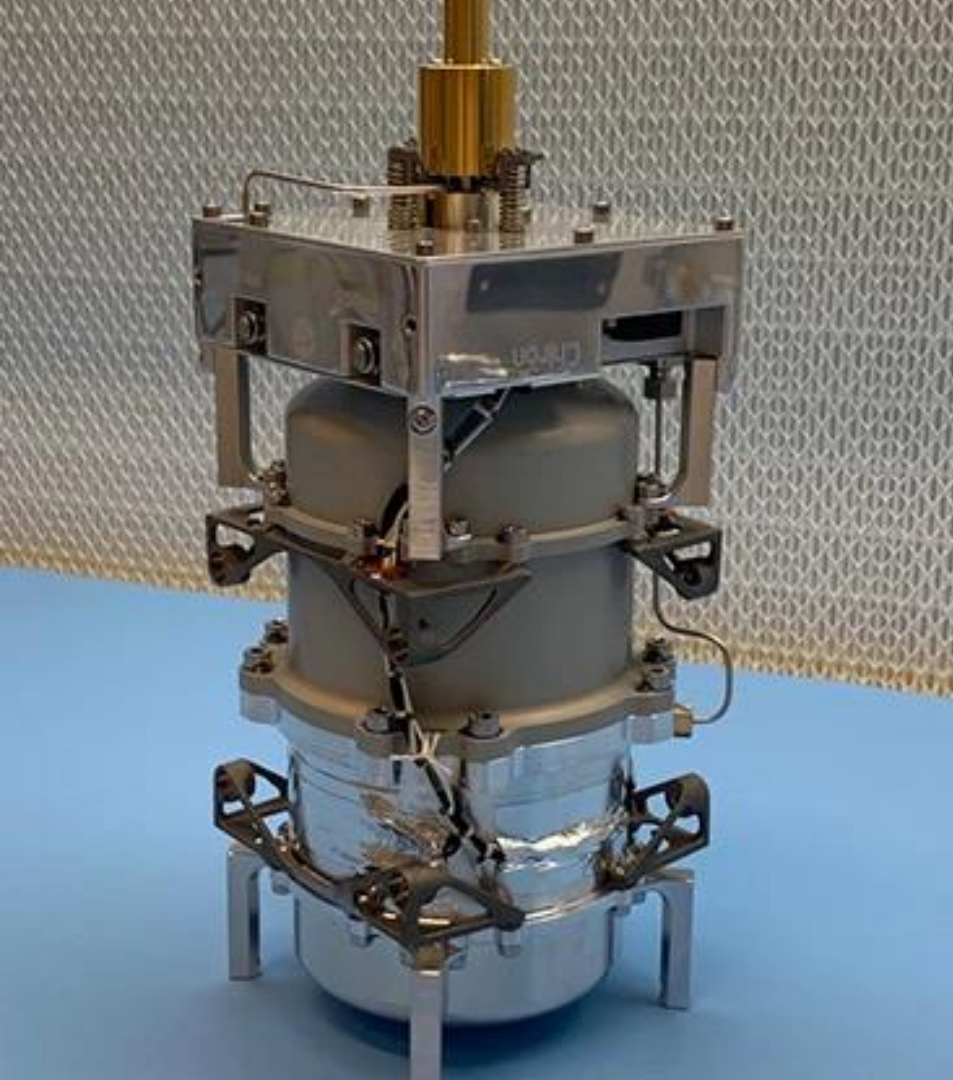


Post-Mod Proposal



(expleo)



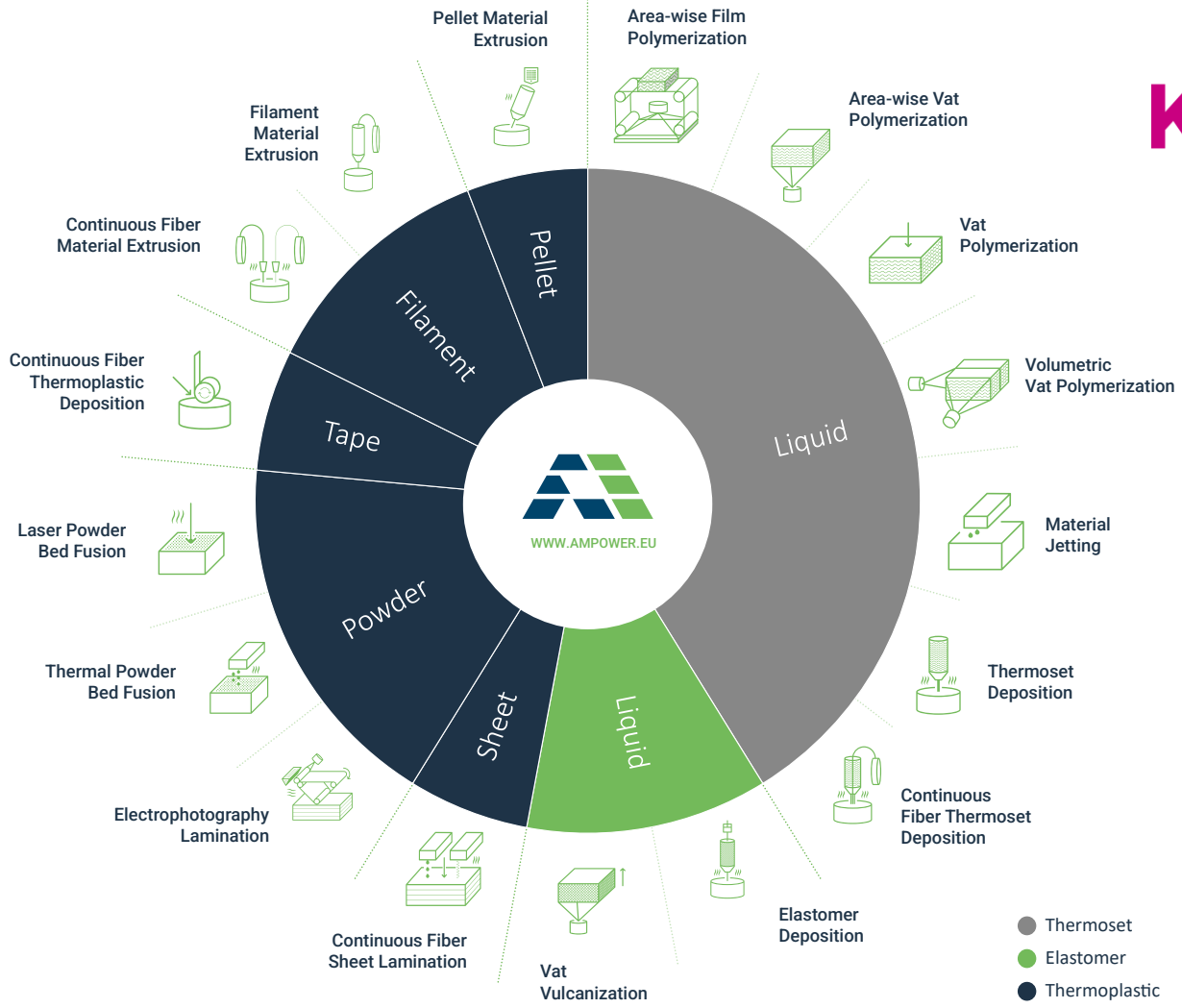


bradford
space

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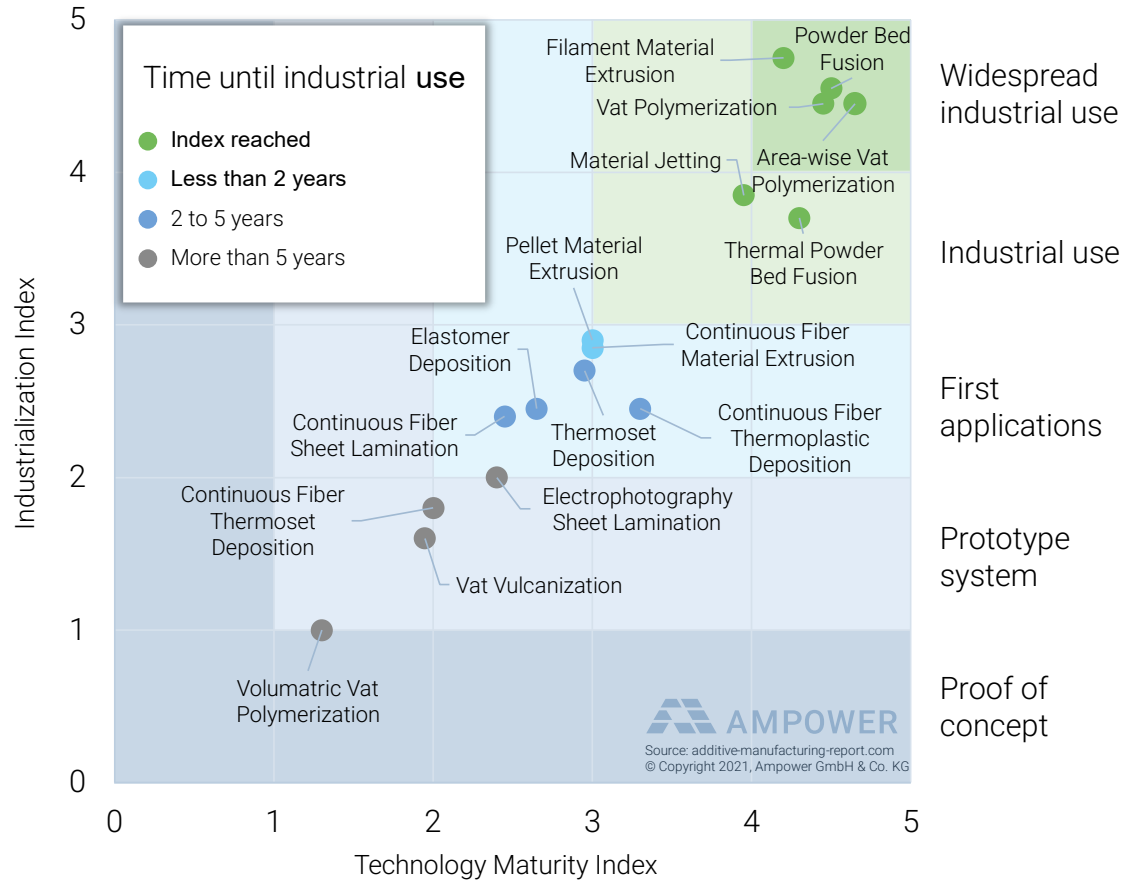


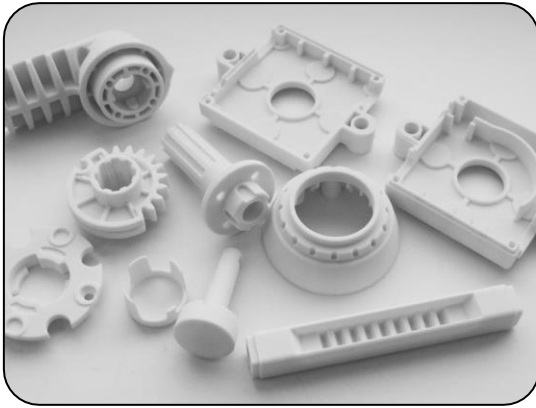
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- Thermoset
- Elastomer
- Thermoplastic

AM Polymer Maturity Index 2022





Stereolithography Apparatus (SLA)

- **Size:** up to 2100x700x800mm
- **Key advantages:** Visual appearance, transparent materials, high accuracy
- **Key disadvantages:** Limited functionality, durability

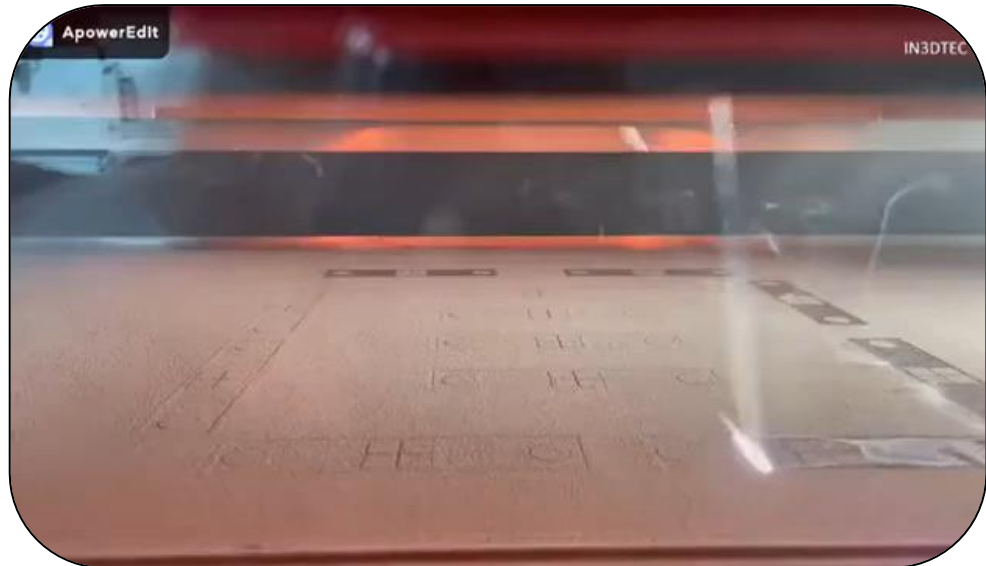


Introduction to Stereolithography



Selective Laser Sintering (SLS)

- **Size:** Approx. 300x300x600mm
- **Key advantages:** Design freedom, no support requirements
- **Key disadvantages:** Surface finish, limited recycling of non-sintered material





Multi Jet Fusion (MJF)

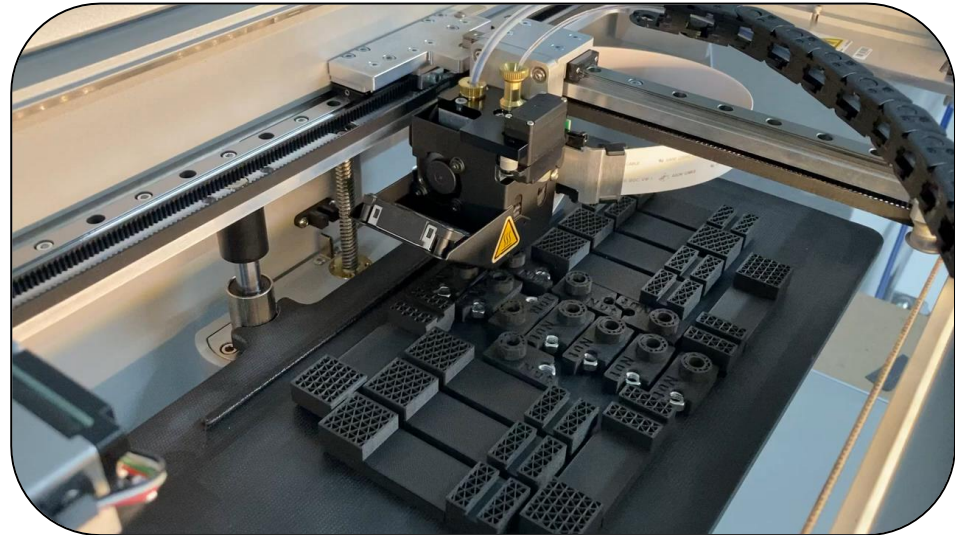
- **Size:** Less than 500x500x500mm
- **Key advantages:** High complexity, designed for high volume production
- **Key disadvantages:** Expensive machinery & supplies

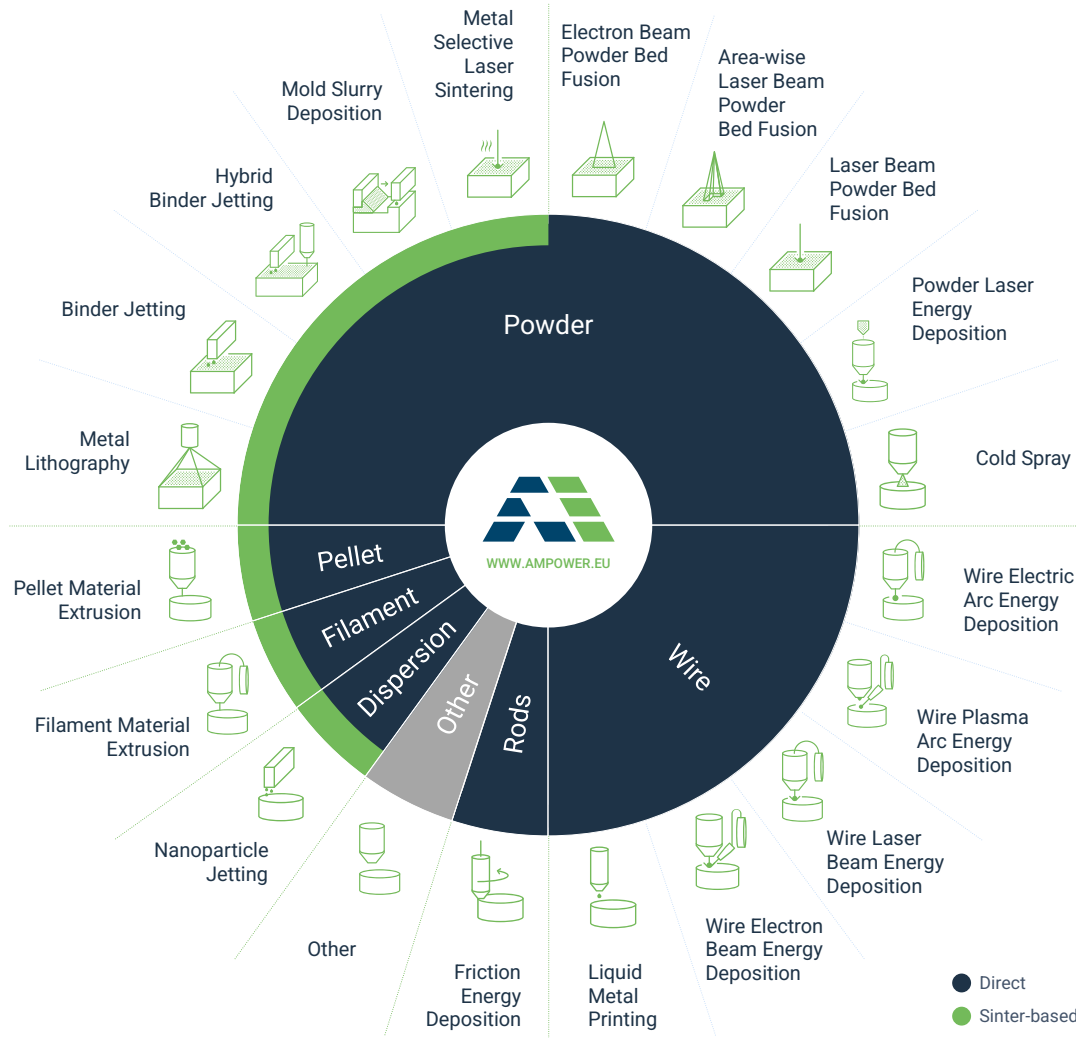




Fused Filament Fabrication (FFF / FDM)

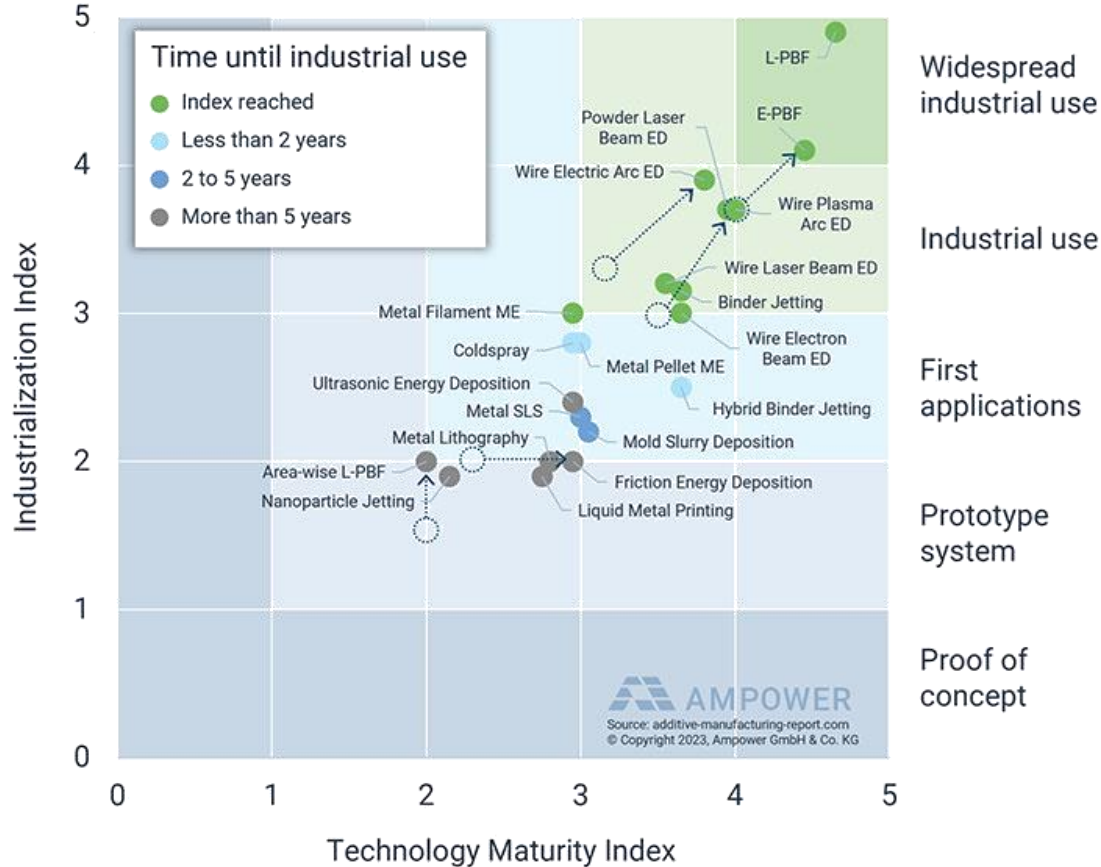
- **Size:** Over 1000x1000x1000m
- **Key advantages:** Ease of use, continuous fiber reinforcement
- **Key disadvantages:** Less suitable for large series, visually less attractive





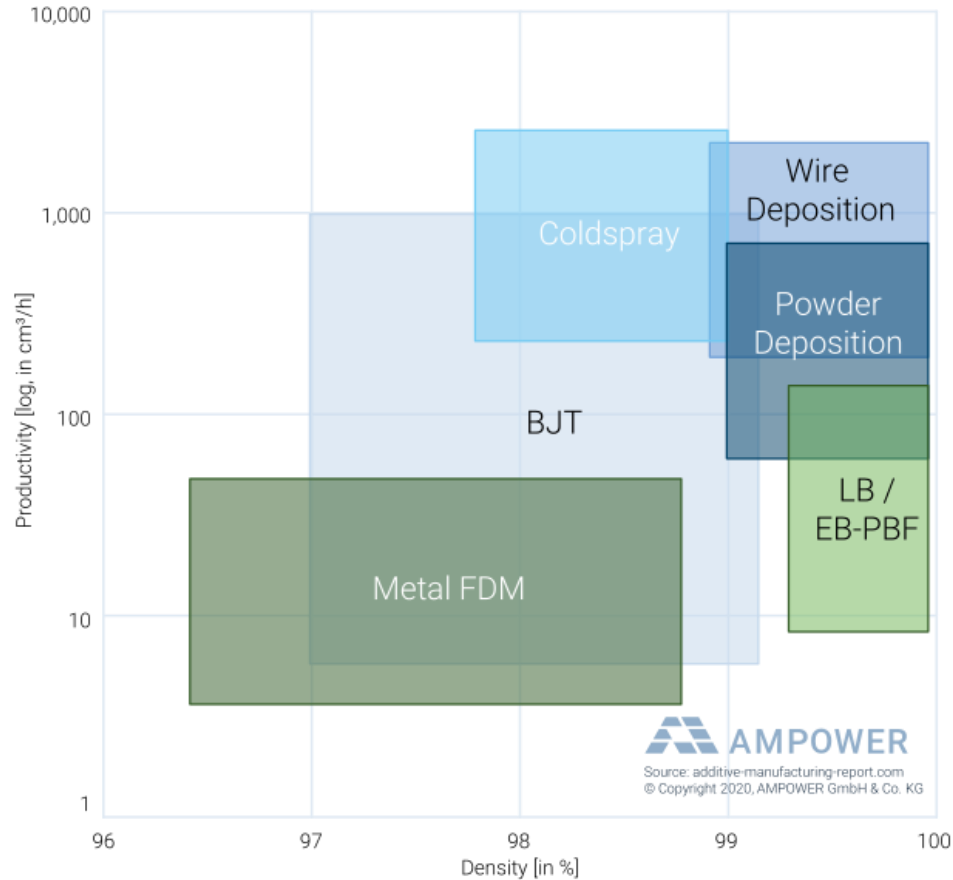
● Direct
● Sinter-based

AMPOWER Maturity Index: Metal AM 2023



Material performance vs. productivity

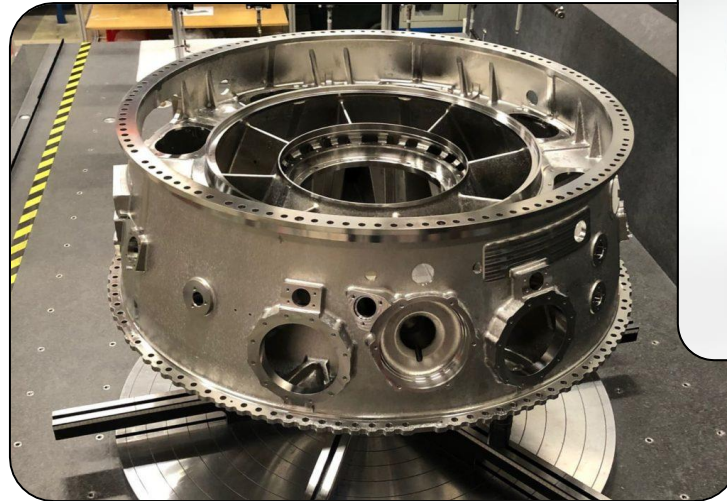
Exemplary performance in terms of density





Laser Powder Bed Fusion (L-PBF / SLM)

- **Size:** up to 600x600x1500mm
- **Key advantages:** High complexity, fully dense, high accuracy
- **Key disadvantages:** Slow compared to other AM Metal technologies





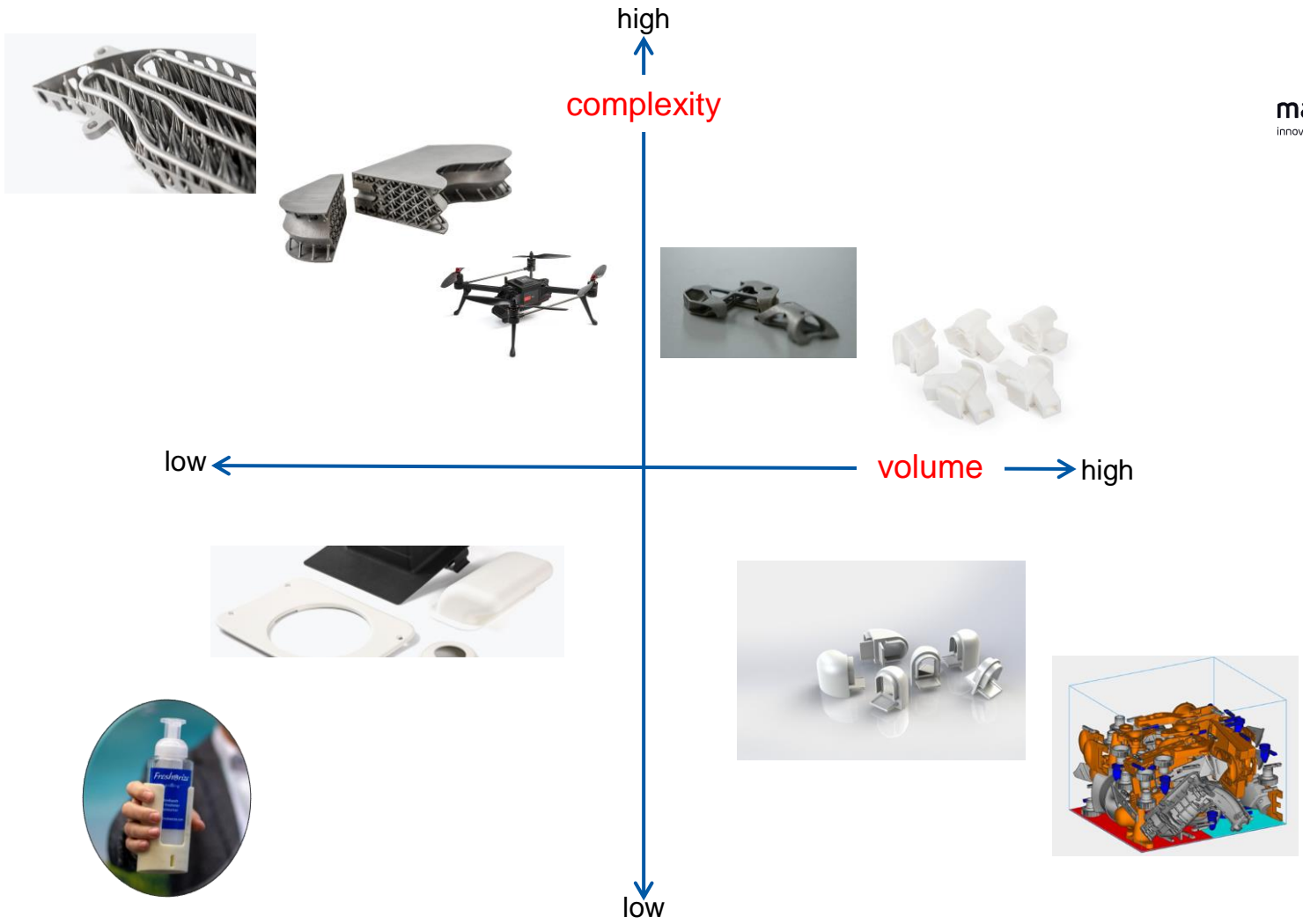
Directed Energy Deposition (WAAM / LMD / etc)



- **Size:** Virtually unlimited
- **Key advantages:** Size, production speed, multi-material
- **Key disadvantages:** Low accuracy, rough near-net-shape surface



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Pitfalls..



Underestimating the complexity of AM



Technique as starting point



Price as first knock-out criterium



Low Management Involvement



Thank you for your attention!

