



Additive Manufacturing: Markt und Trends

28. Fachtagung Rapid Prototyping

Lemgo, 20.10.2023

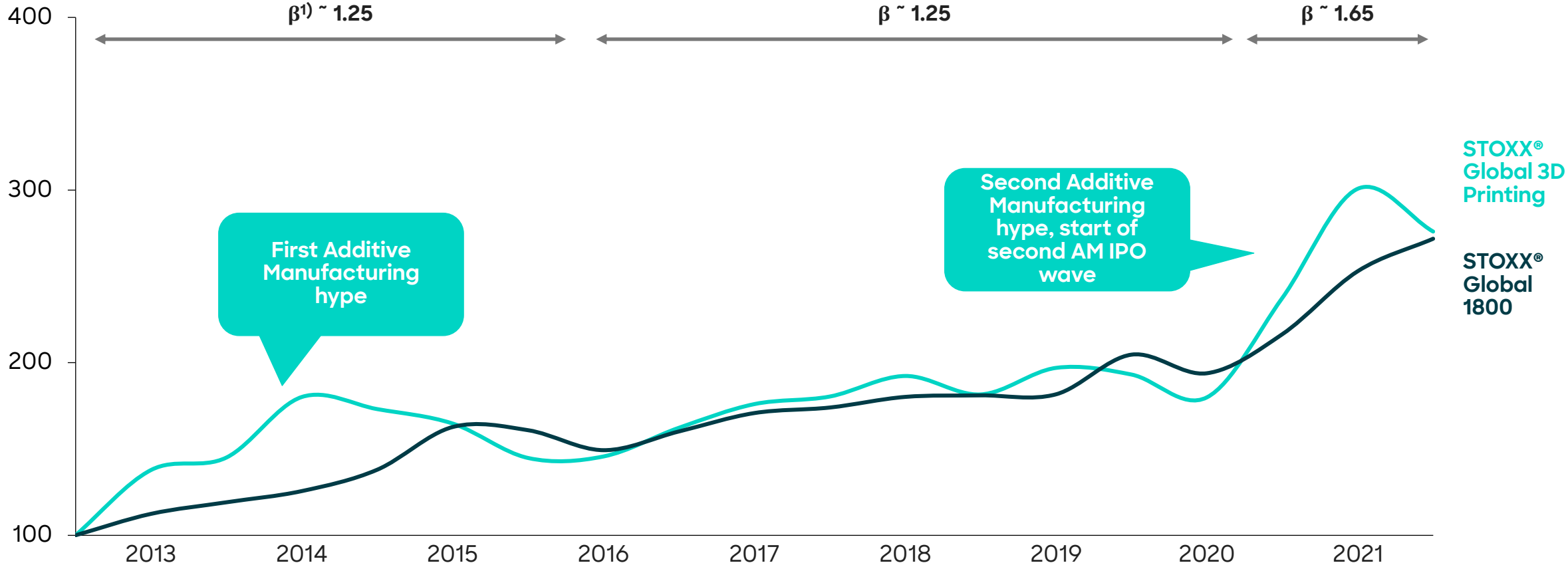
Roland
Berger



A. Market development

Stock developed of Additive Manufacturing companies against general market development

1st and 2nd Additive Manufacturing hype [indexed to 100 in 2012]



1) Raw beta of Stoxx Global 3D printing vs. Stoxx Global 1800

The drivers behind the money

Key trends for investments in the AM market

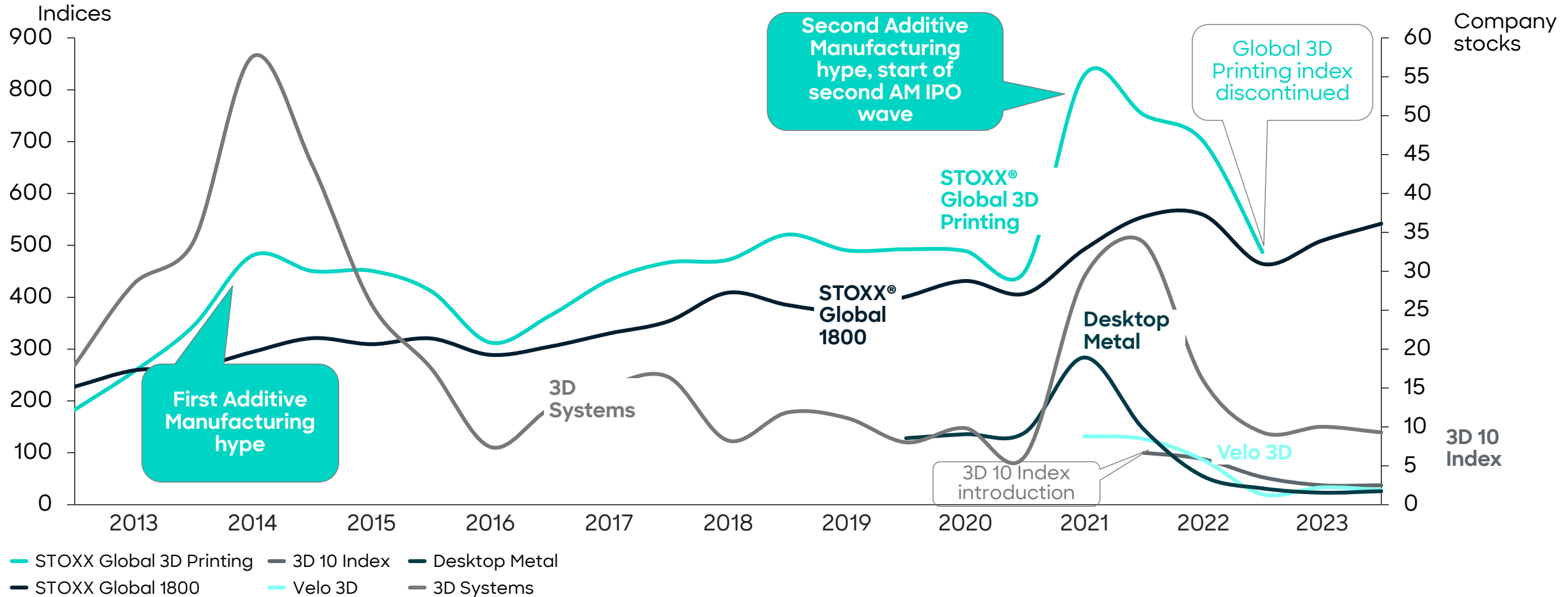
	1 Digitization & high-tech	2 Growth rates & expectations	3 Media & Marketing	4 Low market entry barriers	5 Low interest rates	6 Proximity to potent capital
	<ul style="list-style-type: none"> Digital applications are key for high cost and high-tech countries 	<ul style="list-style-type: none"> Double digit growth in most AM segments and value-chain parts - However expectations go even beyond reality 	<ul style="list-style-type: none"> Media/press hype about size, growth and technology Little public insights to high costs structure and real profitability 	<ul style="list-style-type: none"> Ever increasing number of players in materials, machines and services Significant patents have expired 	<ul style="list-style-type: none"> Low interest rates make alternative investments less attractive 	<ul style="list-style-type: none"> Market participants are close to investors with large funds available in aerospace, medical technology and automotive
Driver relevance						
Expected Development 2021 vs. 2023						

Low current relevance of driver
 High current relevance of driver
 Increasing expected future development
 Decreasing expected future development

2021
 2023

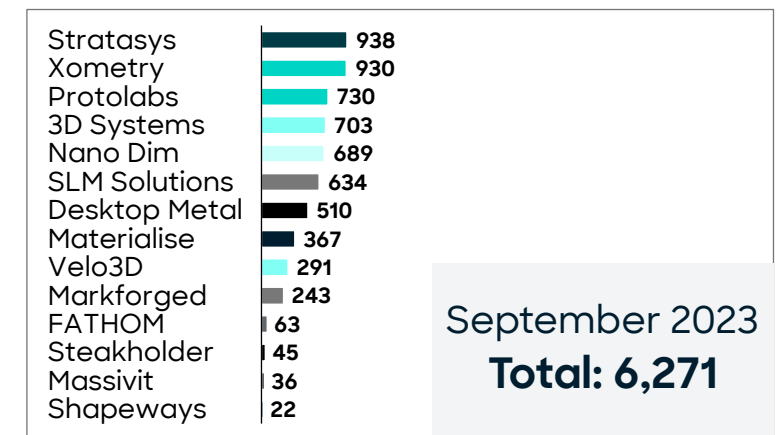
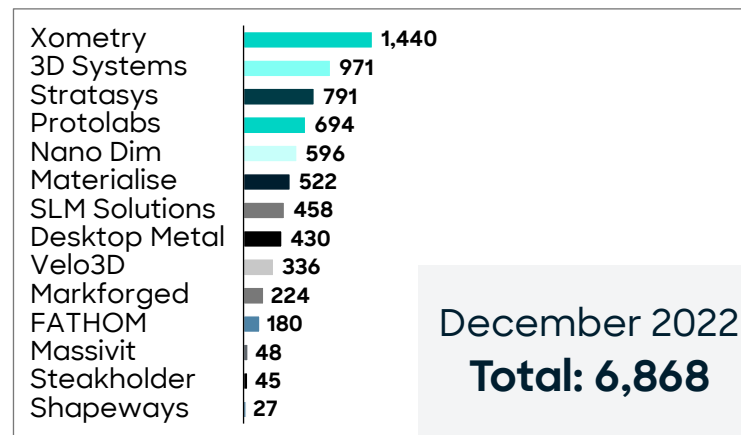
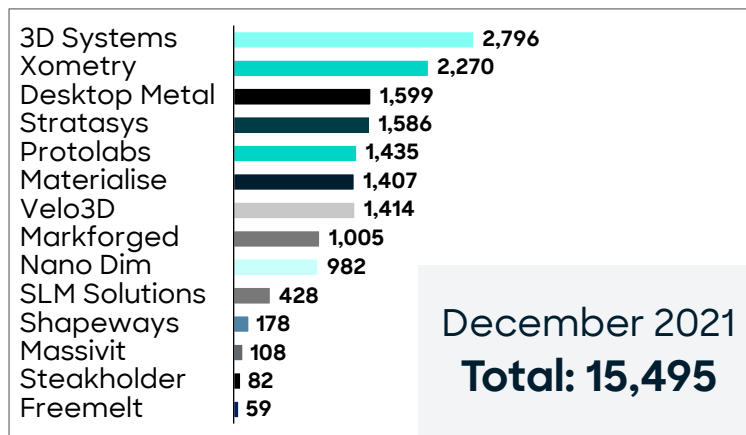
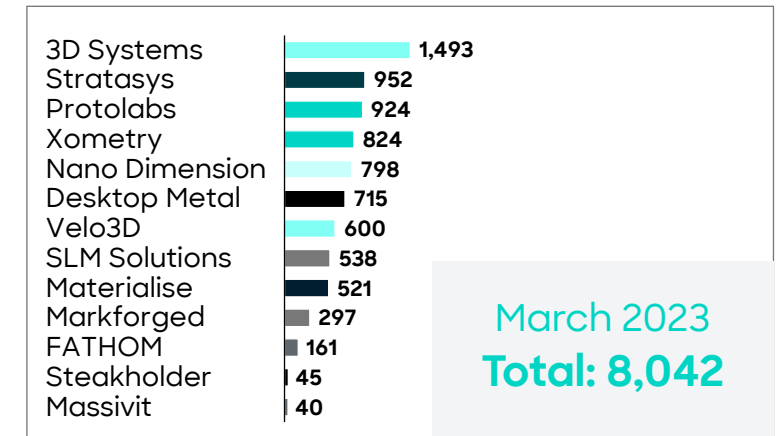
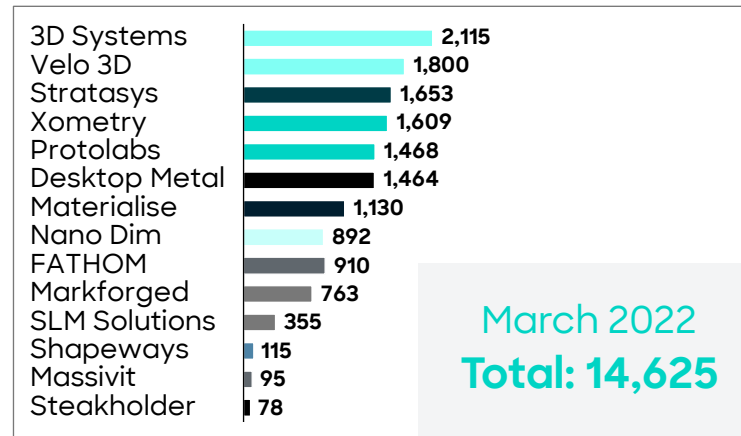
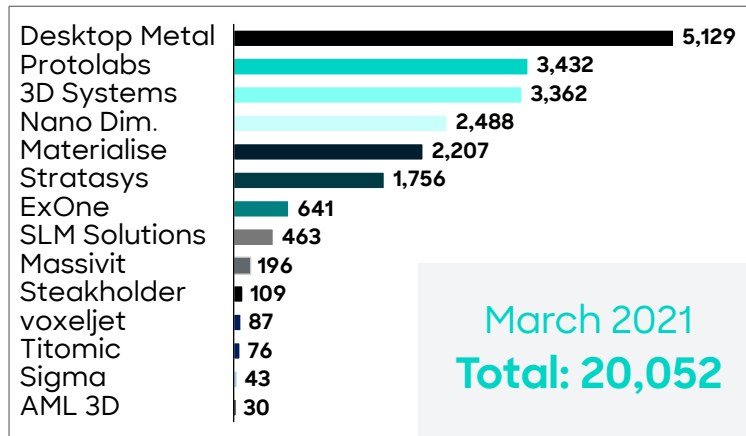
Stock development of Additive Manufacturing companies against general market development indicates generally declining market size

Additive Manufacturing stock market development (2012-2023) [EUR]



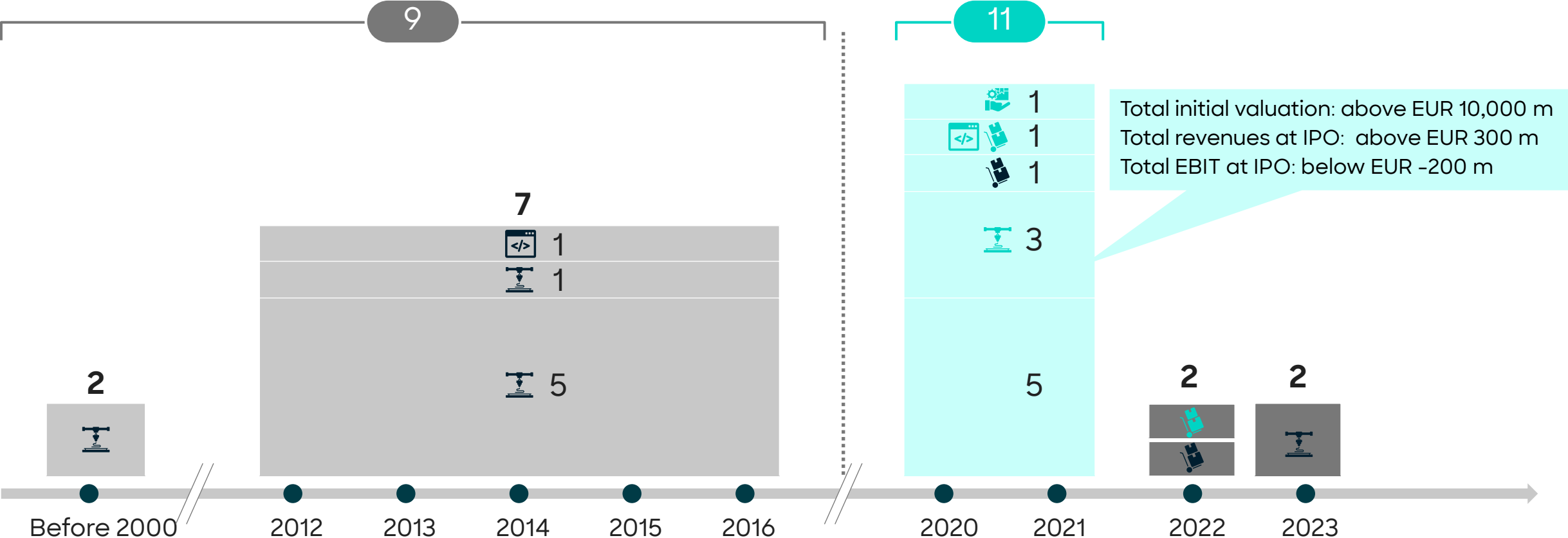
Stock-listed AM companies display highly variable valuations within the past 3 years - overall shrinking market

Valuation of stock-listed Additive Manufacturing company, 2021-2023 [USD m]



In 2020/2021, significant number of IPOs were announced with a very large amount of capital raised for the AM companies

AM related IPO history and near future



Company types

- Metal
- Machine
- Service
- User
- Network
- Software
- Others

IPO types

- Traditional
- Special Purpose Acquisition Company
- Reverse merger

2021 was an outstanding year for Additive Manufacturing related M&A deals with 47 deals - Deals have dropped significantly in 2022/2023

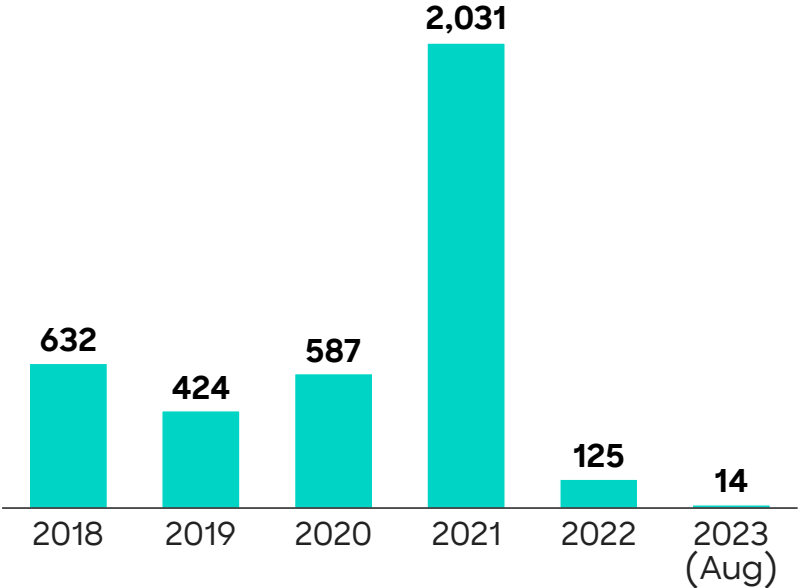
Overview of AM related M&A deals, without IPOs

2018-2023

Deals [# / year] 33 40 23 47 12 2

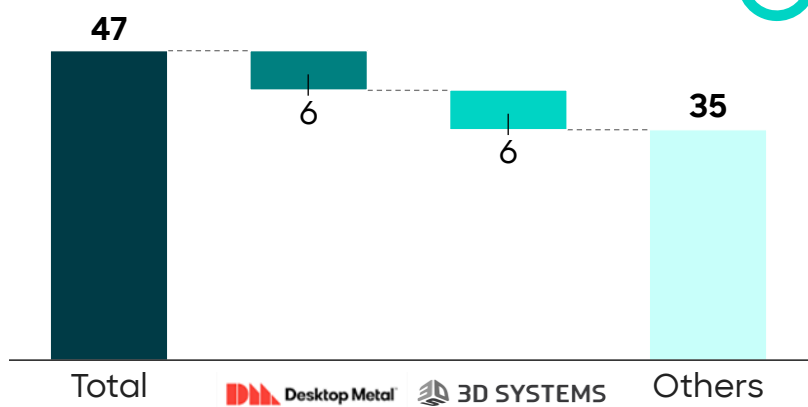
Average disclosed deal value [EUR m] 63 212 73 107 31 14

Sum of disclosed deal values [EUR m]



2021

Number of AM related M&A in 2021 deals



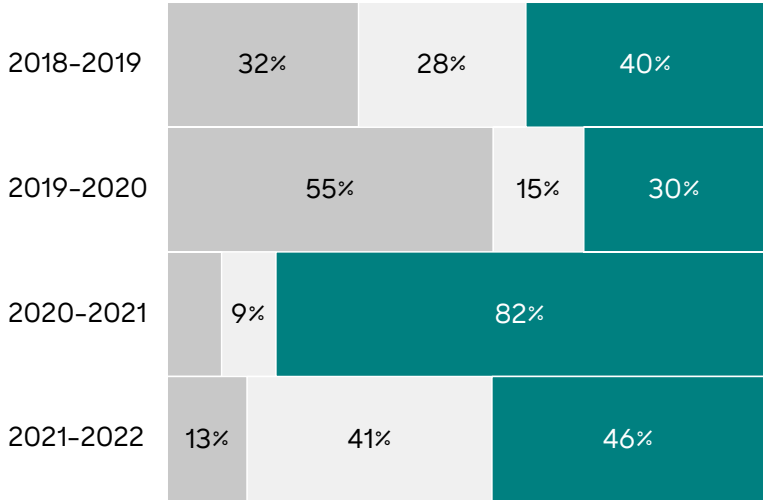
Strong focus on AM machines: AM M&A deal category of ...



The overall AM market is growing double digit, however still >60% of pure AM companies do not post a profit with high CAPEX investment needs

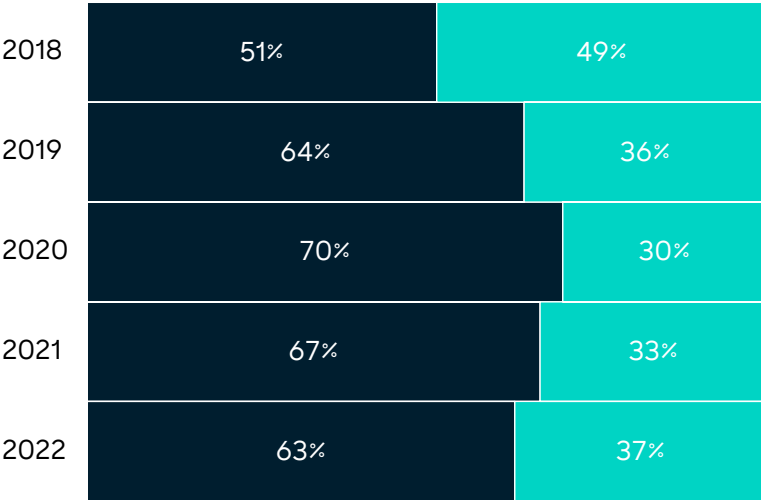
Current market situation of pure AM companies⁴⁾

46% grew >10% in 2022



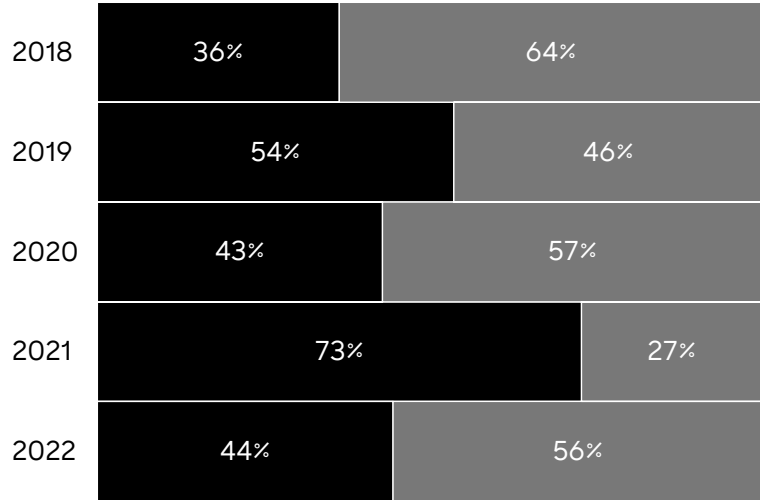
■ Revenue growth > 10%
 ■ Revenue growth < 0%
■ Revenue growth 0-10%

~40% EBIT >0%



■ EBIT margin > 0%
■ EBIT margin < 0%

Mid-to-high



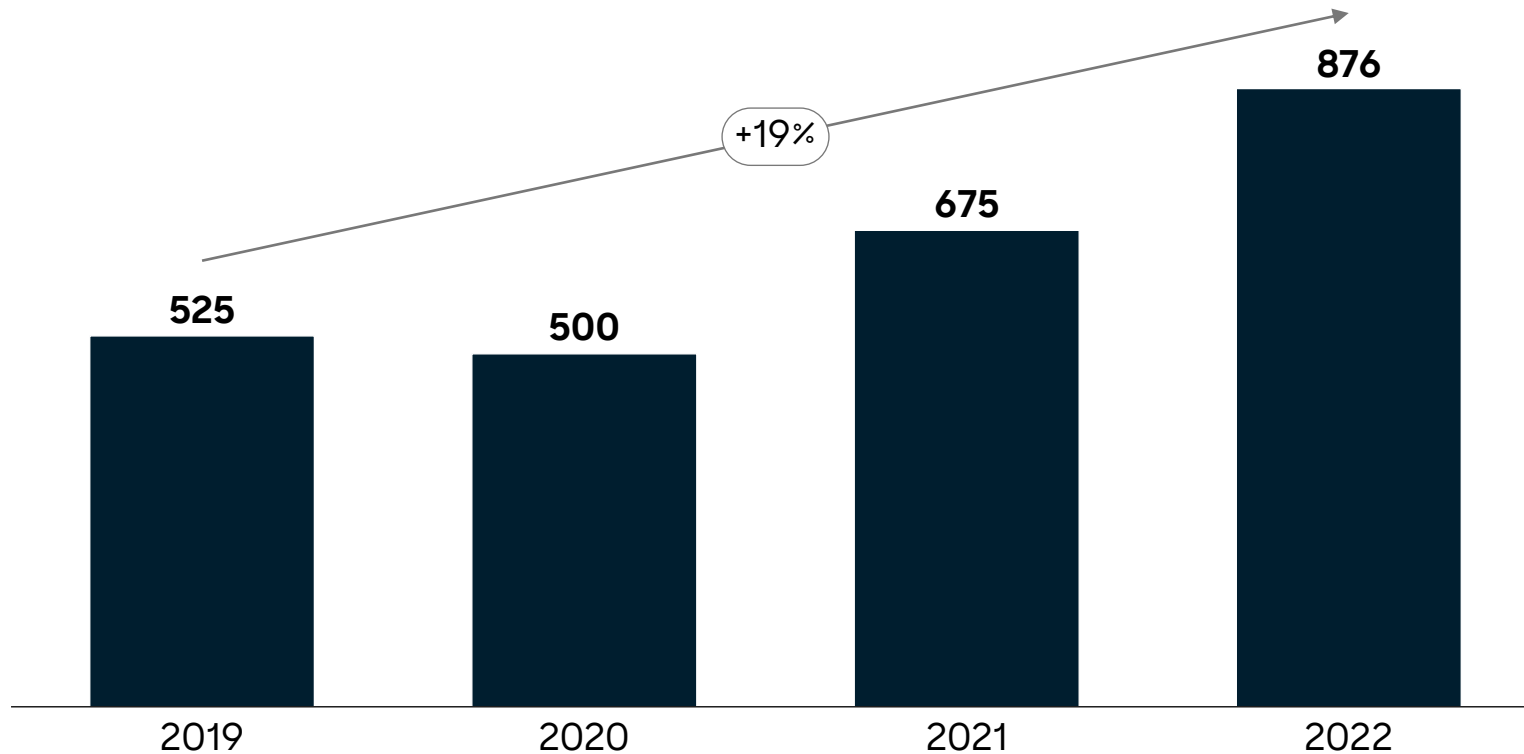
CAPEX as % of Revenue
■ > 5%
■ < 5%

1) FCFF: Free cash flow to firm; 2) +Depreciation & Amortization - Taxes - ΔNet Working Capital; 3) WACC: Weighted average cost of capital;
 4) AM company sample size ~50 companies with dominant business in AM, incl. 10 publicly listed companies and 40 publicly disclosed financial statements

The on-demand manufacturing platform market has been tremendously growing in the last years, fueled by the COVID pandemic and supply chain disruptions

On-demand manufacturing platform market development and characteristics

Revenue of top 4 on-demand manufacturing platforms, 2019-2022 [EUR m]



Market characteristics, 2019-2022

- High **company-individual growth rates** of up to **50%** (CAGR, 2019-2022)
- **Not yet all** market participants **profitable**
- **Several IPOs executed** in the last five years, but many **small- to mid-sized** players **still work on venture capital**
- Highly **dynamic M&A** scene, with more than **30 M&A activities** in the last five years, sometimes **surpassing EUR 200 m** in individual transaction volume

Recently, AM parts platforms have entered the market space and are providing extra benefits to AM part end-users

The AM parts platform providers

AM platform provider	Post-processing provision	Instant quoting	Certified suppliers	Ensured parts quality	Offer of testing	Digital parts library	Operates own printers
HUBS <small>A PROTOPLABS COMPANY</small>	█	█	█	█	█	░	█
SHAPEWAYS	█	█	░	░	░	█	█
MakerVerse	█	█	█	█	█	░	░
replique	█	░	█	█	█	█	░
Xometry	█	█	█	█	█	░	░
PROTIQ <small>A Phoenix Contact Company</small>	█	█	█	█	█	░	█
3DEXPERIENCE Marketplace Make <small>DASSAULT SYSTEMES</small>	░	█	░	█	░	░	░

Category full filled
 Category partially full filled
 Category not full filled

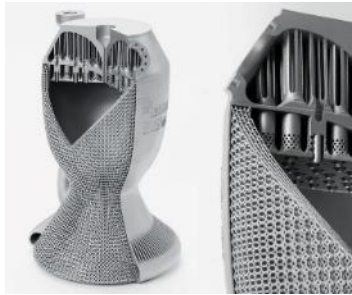


B. Selected Metal AM Trends

With larger machines available bigger parts become assessable in the market, esp. for the aerospace industry

Demand for large-scale machines: Examples for large scale LMF applications

Rocket engine part



Description:
Thrust chamber

Material:
IN718

90 cm

Aerospace TCF casing

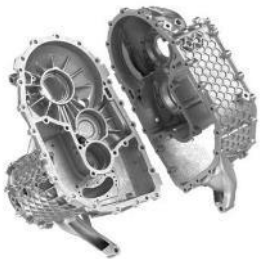


Description:
Advanced Additive Integrated Turbine Centre Frame (TCF) casing

Material:
IN718

100 cm

EV motorhousing



Description:
E-drive housing

Material:
AlSi10Mg

50 cm

Complex rocket injector head



Description:
Rocket injector head re-engineers itself, based on the printers' capabilities to print overhangs and thin walls

















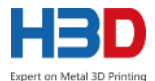






















Material:
IN718

30 cm

- **AM technologies** have evolved to manufacture bigger parts for various industries
- **New applications** are made available by bigger machines and higher number of operating lasers
- New industries can be served, and **broader range of application** is possible
- **Focus of market assessment** is primarily on LMF and E-PBF

Chinese L-PBF machine OEMs have recently announced the machines with the largest build-size and most lasers...

Overview of Chinese metal AM machine OEM product portfolio (excerpt)

Company	Example	Small machines	Med. machines	Large machines (2x laser)	Large machines (4x laser)	Large machines (>4x laser)	Extra-large machines (>4x laser)
Bright Laser Technologies 		 BLT-A160 ⇄ 160x160x100 mm ³ 1x/2x 200W	 BLT-S320 ⇄ 250x250x300 mm ³ 1x/2x 500 W	 BLT-S400 ⇄ 400x250x400 mm ³ 2x/3x 500 W	 BLT-S510 ⇄ 500x500x1000 mm ³ 4x 500 W	 BLT-C400 ⇄ 400x400x400 mm ³ 8x 1,000 W	 BLT-S800 ⇄ 800x800x600 mm ³ 6x/8x/10x/20x 500 W
Farsoon Technologies 		 FS121M ⇄ 120x120x100 mm ³ 1x 200 W	 FS273M ⇄ 275x275x355 mm ³ 1x/2x 500 W	 FS421M ⇄ 425x425x420 mm ³ 1x/2x 500 W	 FS721M-4 ⇄ 720x420x420 mm ³ 2x/4x 500 W	 FS721M-8 ⇄ 720x420x420 mm ³ 8x 1,000 W	 FS1521M-6 ⇄ 1,530x1,650 mm ³ 16x 500 W
HanBang 3D 		 HBD-150 ⇄ d=159x100 mm ³ 1x/2x 200 W	 HBD-200 ⇄ 270x170x120 mm ³ 2x 200 W	 HBD E500 ⇄ 430x520x520 mm ³ 2x/3x 500 W	 HBD 1000 ⇄ 600x600x1000 mm ³ 4x 500/1000 W		Farsoon and Toolcraft as development partners since Feb. 2023
E-Plus-3D 		 M150 ⇄ d=156x240 mm ³ 1x/2x 500 W	 M250 PRO ⇄ 262x262x350 mm ³ 1x/2x 500 W	 EP-M300 ⇄ 305x305x450 mm ³ 1x/2x 500/1000 W	 EP-M650 ⇄ 655x655x800 mm ³ 4x 500 W		 EP-M1250 ⇄ 1258x1258x1350 mm ³ 9x 500/700/1000 W
ZRapid 		 iSLM160 ⇄ 110x130x185 mm ³ 1x 200/500 W		 iSLM 420D ⇄ 265x145x270 mm ³ 2x 500 W	 iSLM 600QN ⇄ 330x165x405 mm ³ 4x 500/1000 W		

Rising demand for AM production from the growing space and semiconductor industries as driver for AM

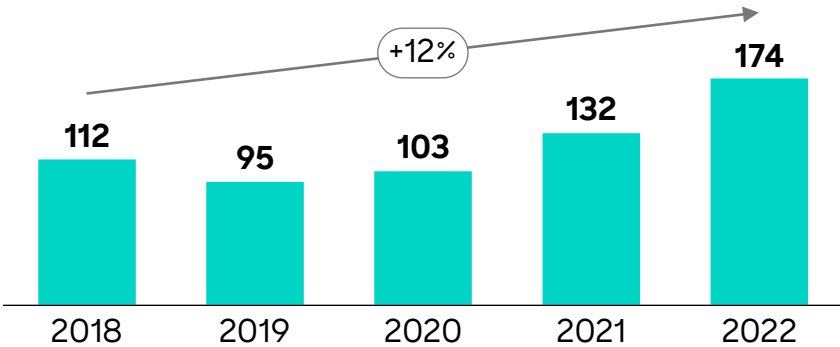
Driver applications for Additive Manufacturing

Rocket engine parts



- The global satellite and space launches market has grown strongly in the past
- North America is the dominant region in terms of the number of launches, approx. accounts for 41.9% of all launches in 2022, followed by Asia-Pacific (39.2%) and Europe (14.5%)

of rocket launches [#]

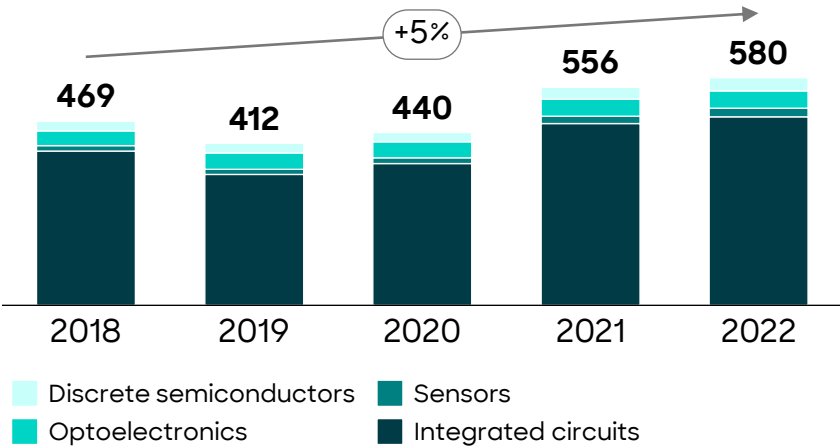


Semiconductor production equipment parts



- The global semiconductor market has grown significantly in the past years, especially after COVID it grew by 26% (2019 to 2020)
- It is expected to continue to grow at moderate level and remain a highly demanded product

Global semiconductor market size [USD bn]



- Growing applications of LBF printed products drive the market for AM OEMs
- Potential **specification**/niche possible
- AM enables production of **complex geometries** with **controlled heat dissipation**
- Small batch sizes

Low-cost providers push into the AM market

Recent AM industry news



One Click Metal releases evolution of its AM machine with the MPRINT+

March 24, 2021



The MPRINT+ machine is said to allow a manufacturing cost reduction of up to 40% (Courtesy One Click Metal)

The MPRINT+ is available with the MPREP data preparation software and the MPURE unpacking station with integrated automatic sieving unit is currently available at €100,000. The first machines have already sold, with deliveries scheduled from Q2 2021.



Xact Metal bringt XM200G Metall-3D-Drucker auf den Markt

von 3Druck.com - Nov 17, 2021



Der Metall-3D-Drucker-Hersteller Xact Metal hat seine XM200G-Serie auf den Markt gebracht und gleichzeitig den Preis der XM200C-Serie auf 65.000 US-Dollar gesenkt.

Auf der Formnext 2021 hat der Metall-AM-Spezialist sein neues XM200G-System angekündigt. Die neue Maschine hat ein

Bauvolumen von 150 x 150 x 150 mm und bietet den Anwendern die Möglichkeit einer Einzel- oder Doppellaserkonfiguration, wobei 100, 200 und 400 W Faserlaser zur Verfügung stehen. Es basiert im Wesentlichen auf der gleichen Architektur wie das XM200C-System, verwendet jedoch ein Hochleistungs-Galvanometersystem, um schnellere Druckzeiten zu ermöglichen und eine Multi-Laser-Konfiguration zu unterstützen.gestattet .

Bei Einsatz einer Multilaserkonfiguration kann die XM200G eine 100%ige Überlappungsfläche bei 100µm Spotgröße oder eine 66%ige Überlappungsfläche bei 50µm Spotgröße bieten. Laut Xact Metal eignet sich die Maschine für Kunden, die in den 3D-Metalldruck für die Produktentwicklung und den Werkzeugbau einsteigen, sowie für Kunden in Forschung und Lehre.

Im Einklang mit der Einführung der XM200G ist der Preis der XM200C von zuvor 90.000 \$ auf 65.000 \$ gesunken.



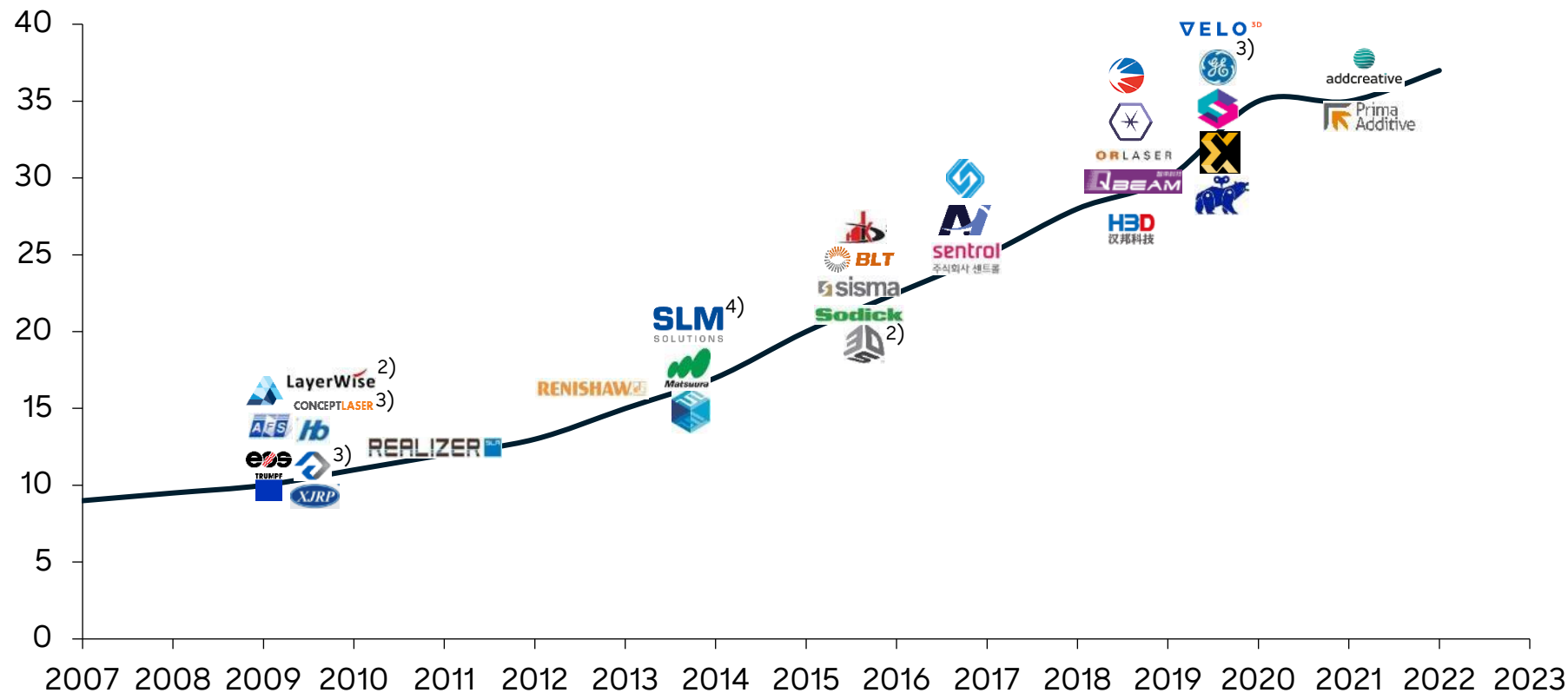
German manufacturer of industrial laser systems, O.R. Lasertechnologie GmbH (OR LASER), will unveil its new direct metal additive manufacturing platform to visitors at the upcoming formnext exhibition in Frankfurt next week.

The ORLAS CREATOR metal 3D printer is specifically targeted at small and medium sized enterprises (SMEs), particularly in the jewellery, dentistry, and medical sectors as well as for smaller engineering firms and laboratories. Due to the cost of large metal AM machines, these companies have so far not been able to afford such systems.

The printer's build platform is original in design and functionality, an innovative blade design ensures smooth operation and increased build speed that produce parts up to 30% faster according to OR LASER. It utilises a cartridge materials handling system for the powder; cartridges for the open material system can also be supplied by OR LASER. Parts produced on the ORLAS CREATOR feature resolution that is comparable with higher spec machines on the market.

Stagnating number of metal AM machine manufacturing OEMs for PBF – lower market growth pressures profitability

of metal AM machine manufacturing OEMs (excerpt)¹⁾, 2007-2022



— PBF

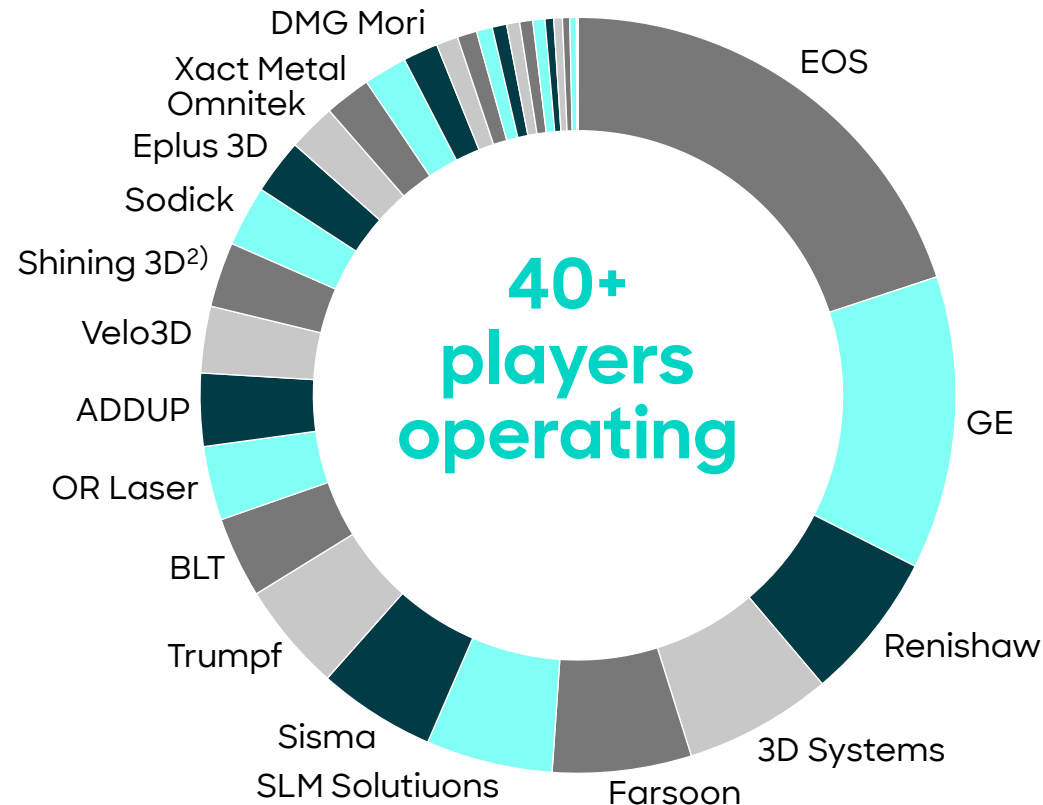
1) Only OEMs with proven machine sales are shown (OEMs without sales: PBF 20, DED 7). Acquisition and closure of a business included in # of OEMs; 2) 3D-Systems acquired LayerWise; 3) GE acquired Concept Laser and Arcam; 4) SLM arose from MTT; 5) DMG Mori acquired Realizer

- The market is **highly fragmented**
- **Market entry** of new players has **slowed down**
- **Many players** were **founded** during the **second Additive Manufacturing hype**
- **Increased number of players** in the past with market **growth rates lower** than expected **pressures profitability** of AM OEMs

The metal AM machine market is highly fragmented with most players having a sub-critical market share

Market shares of metal AM machine¹⁾ OEMs [%-number of machines]

Market share detailing - Metal



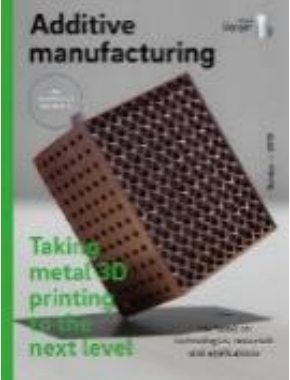
- The market is highly fragmented
- Only a few have >10%
- A limited number operate at 2-5%, most players are under critical <2% share

1) Powder Bed Fusion only; 2) Shining 3D now operating as E-Plus-3D

Overview of our latest freely available material in the AM space



Study 2018



Study 2019



Study 2020



Study 2020



Study 2020



Study 2022



Study 2022



Study 2023



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