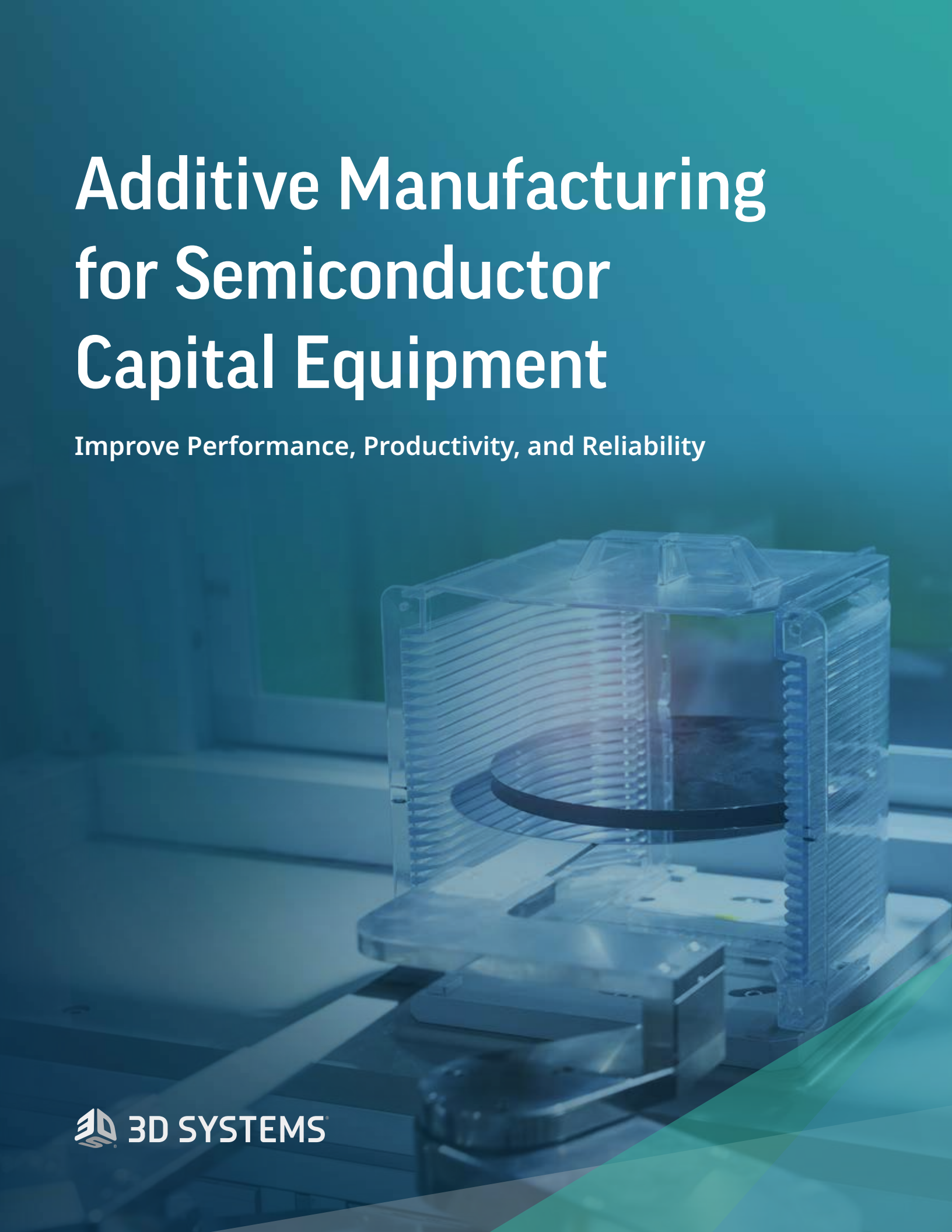
Additive Manufacturing for Semiconductor Capital Equipment

Improve Performance, Productivity, and Reliability



3D SYSTEMS

For over two decades, 3D Systems has perfected proprietary metal 3D printing solutions and semiconductor capital equipment expertise. Our Direct Metal Printing (DMP) family of 3D printers, extensive metal materials and 3DXpert® software enable unprecedented design flexibility, economics, and reliability.

3D Systems helps semiconductor OEMs and tier 1 suppliers establish their own metal additive manufacturing capabilities, while eliminating hidden costs and accelerating ramp times through the hands-on training and consultation of our technology transfer program.

Addressing Semiconductor Capital Equipment Manufacturing Challenges with Additive Manufacturing

As the speed and capability of smart devices expand exponentially, so does the complexity of the microchips that enable them. Rising demand for microchips has made it necessary for semiconductor capital equipment manufacturers to expand production. Commissioning new manufacturing lines capable of meeting modern precision requirements is technically challenging, time consuming, and expensive.

Semiconductor OEMs and tier 1 suppliers are under pressure to deliver higher performance and reliability to the capital equipment that manufactures and inspects these devices.

Manufacturers are looking to advance the performance of high-value lithography and wafer handling systems by improving imaging performance, accuracy, productivity, and reliability within the highest standards of a clean room environment.

Increase Your Machine Accuracy, Speed and Uptime with Expert Additive Manufacturing Solutions

Design Flexibility

Optimally design, rapidly iterate, and manufacture components with complex features, including wafer tables with conformal cooling channels, part-consolidated end effectors, and advanced kinematic couplings and flexures for optical components.

Performance and Productivity

Produce more wafers by improving semiconductor equipment accuracy, speed, reliability, and throughput. Realize performance benefits in critical parts and subsystems, including thermal management, optimal fluid flow, lightweighting, and part consolidation.

High Quality and Accuracy for Clean Room Environments

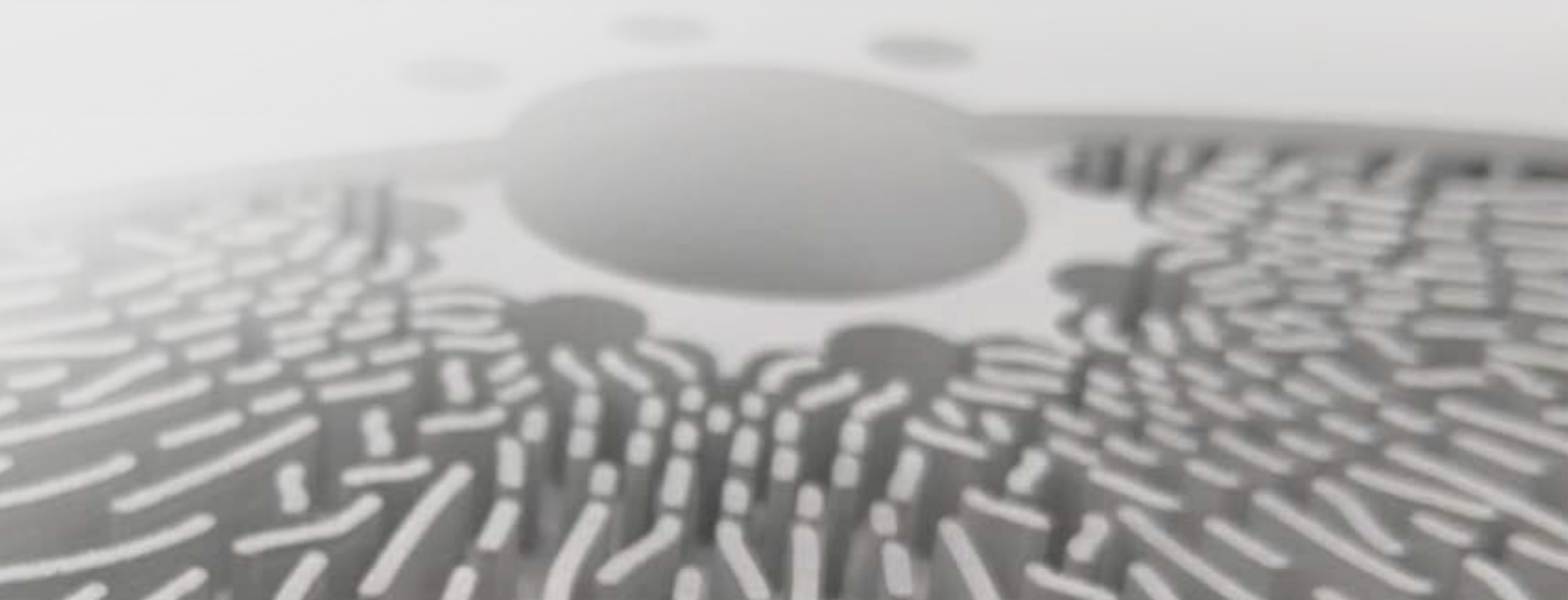
Our metal additive solutions ensure high material quality and part accuracy, producing parts in an inert atmosphere with a steady, ultra-low oxygen level — coupled with proprietary processes for optimal particle cleanliness. This results in metal parts that meet clean room requirements and are fit for use in high vacuum environments.

Metal Additive Manufacturing Expertise and Capability

Establish your own metal additive manufacturing capabilities and quickly scale to production volumes while partnering with us to develop new concepts prototypes.

Scalability and Risk Reduction

Our manufacturing facilities offer increased capacity, flexibility, and reduced inventory. We can help eliminate supply chain risks for OEMs through technology transfer by replicating our manufacturing processes and qualifying your suppliers.



How 3D Systems' Metal Additive Manufacturing Enhances Semiconductor Equipment Performance and Economics

Additive manufacturing allows semiconductor capital equipment manufacturers and suppliers to cost-effectively optimize metal component designs, maximizing performance, yield, and reliability of semiconductor capital equipment.

Rapidly design and deliver metal parts with lower weight and fewer assemblies to enhance fluid flow, system functionality, and overall equipment longevity.

Manifold and Tubing Flow Optimization

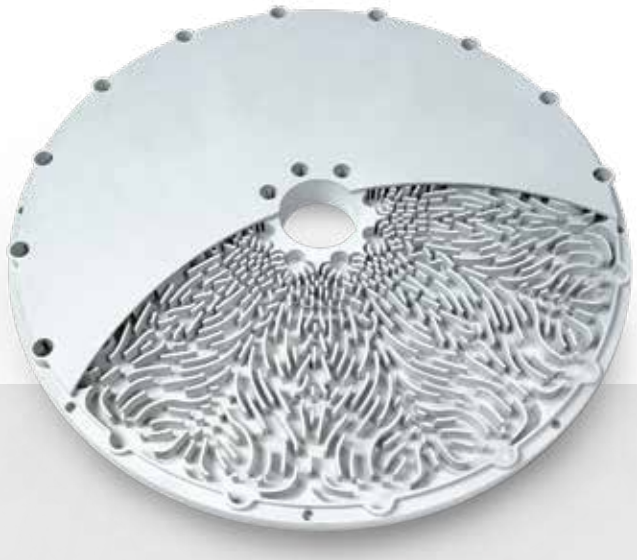
Design and manufacture superior-performing manifolds with optimized flow to reduce pressure drop, mechanical disturbances, and vibration. Replace multipart assemblies with monolithic parts for increased reliability, improved manufacturing, and yield.

- 90% reduction in disturbance forces
- 1-2 nm process accuracy improvement
- 10:1 part count reduction
- Reduction in spatial volume while achieving ideal function

Wafer Table Thermal Management

Maximize heat transfer efficiency and improve semiconductor capital equipment throughput and accuracy. Optimized cooling channels and surface patterns dramatically improve surface temperatures and thermal gradients (<4 mK) while reducing time constants (<1.5 s), which enhances system speed and accuracy.

- 5x faster to stable temperature
- 6x reduction in surface temperature gradient (14mk -> 2.3mk)
- 1-2 nm process accuracy improvement
- 2 or more additional wafers produced per week
- Increased reliability of assembly with part count reduction



Flexure and Structural Optimization

Semiconductor lithography, wafer processing, and test equipment rely on structural parts that move fast while maintaining positional accuracy. Improve kinematic and static performance with structural optimization, lightweighting, and part consolidation of optical assembly flexures and mechanisms.

- 50% weight reduction in assemblies
- 23% higher resonant frequency
- 14:1 part count reduction
- Reduced vibration and inertia leading to higher operating speeds
- Increased precision of flexure kinematics

Part Courtesy of VDL

Our Metal 3D Printers, Materials & Software

DMP Factory 350/500 and DMP Flex 350

3D Systems' DMP Flex 350, Factory 350, and Factory 500, together with the 3DXpert® software package, is an integrated metal additive manufacturing solution that delivers superior digital production with optimal throughput, efficiency, capacity, and flexibility.

3D Systems provides a suite of advanced metal materials for every application, including aluminum, titanium, steel, and nickel alloys.

3DXpert is an all-in-one integrated software that streamlines the additive manufacturing workflow, from design to post-processing. It has features for importing, positioning, modifying, optimizing, designing, simulating, analyzing, and programming post-processing operations. 3DXpert is ideal for delivering complex components, including assemblies that reduce part counts, as well as innovative designs that provide greater strength and efficiency, including optimized structures that lower total weight.

Expertise in Metal Additive Parts for Clean Room Environments

3D Systems DMP printers feature unique vacuum chamber technology to reduce argon gas consumption and deliver best-in-class oxygen purity.

The high material quality and part accuracy produced in the inert atmosphere with steady, ultra-low oxygen levels, coupled with proprietary processes for optimal particle cleanliness, result in metal parts that meet semiconductor clean room requirements and are fit for use in lithography equipment.

3D Systems Metal Additive, Consulting & Technology Transfer Services

3D Systems has decades of semiconductor and metal additive manufacturing expertise through our Application Innovation Group (AIG). We find optimal solutions for the world's premier semiconductor capital equipment manufacturers and suppliers, helping them establish their own metal additive capabilities that reduce costs and ramp times.

3D Systems enables your supply chain through a structured technology transfer program that ensures a smooth transition for in-house metal additive manufacturing of semiconductor equipment parts. Through training, consultation, and the transfer of prequalified manufacturing processes to your site, our dedicated team works with you across every step, from part design to post-processing.

PHASE 1 — Gap Assessment

PHASE 2 — DMP Process Controls

PHASE 3 — Post-Processing and Controls

PHASE 4 — Machine Delivery and Installation

PHASE 5 — Up and Running

Advance Equipment Performance with 3D Systems' Additive Manufacturing Solutions

Metal additive manufacturing can give semiconductor capital equipment manufacturers and suppliers the capabilities they need to improve performance, productivity, and reliability. Our technology transfer and consulting services enable you to achieve your goals faster.

Learn how 3D Systems can help you today.

For questions/sales:

3dsystems.com