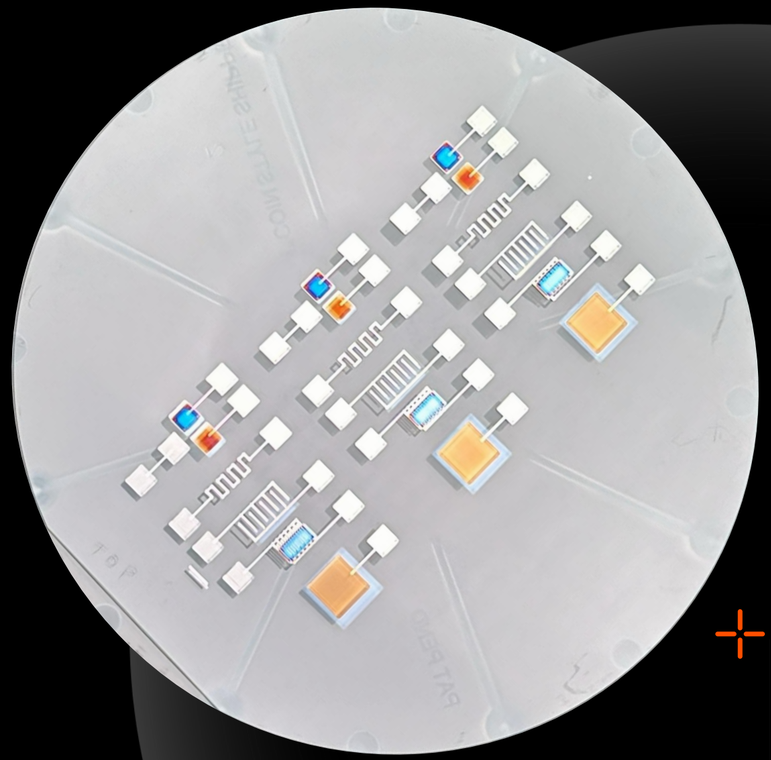
ATLANT 3D®



EMPOWERING PHOTONICS AND MICRO OPTICS INNOVATION VIA DALP TECHNOLOGY

Gauthier Briere – Senior Application Engineer
gbri@atlant3d.com
sales@atlant3d.com

ATLANT AT A GLANCE

FOUNDED 2018

- HQ: Copenhagen Denmark
- US Entity
- UK Entity

PROPRIETARY DALP ®

- Direct Atomic Layer Processing Technology

MARKET FOCUS

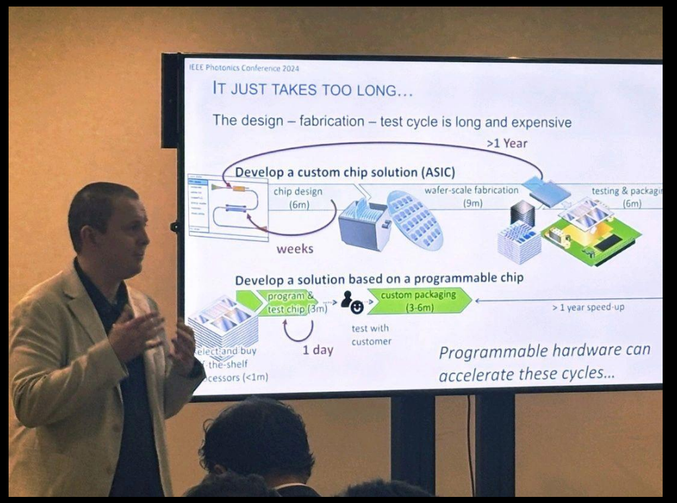
- Fundamental & Industrial R&D
- Emerging Technologies
- Microelectronics
- Optics & Photonics

40 TEAM MEMBERS

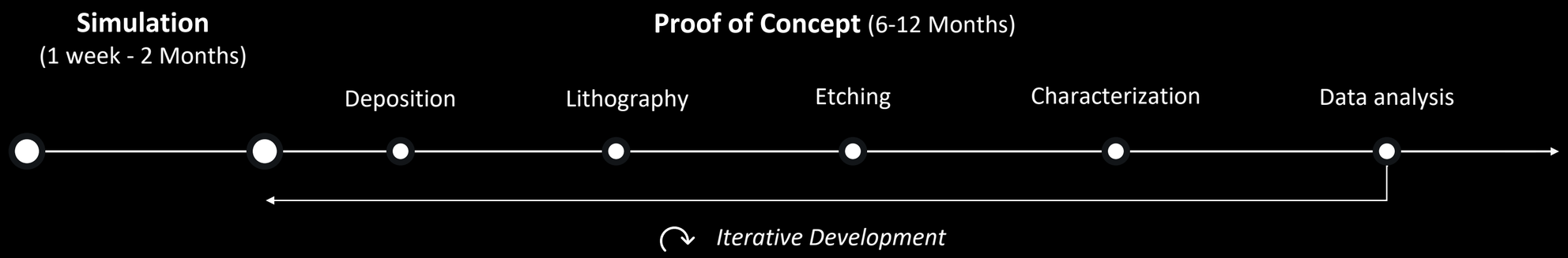
- Expertise in ALD and Material Science,
- Advanced Applications and Devices
- Advanced System and Software Engineering

SONY NASA MERCK esa life.augmented WEST HILL Innovationsfonden European Commission

• THIS INFRASTRUCTURE SLOWS R&D AND LIMITS DESIGN COMPLEXITY



Wim Boagerts – Ugent-Imec



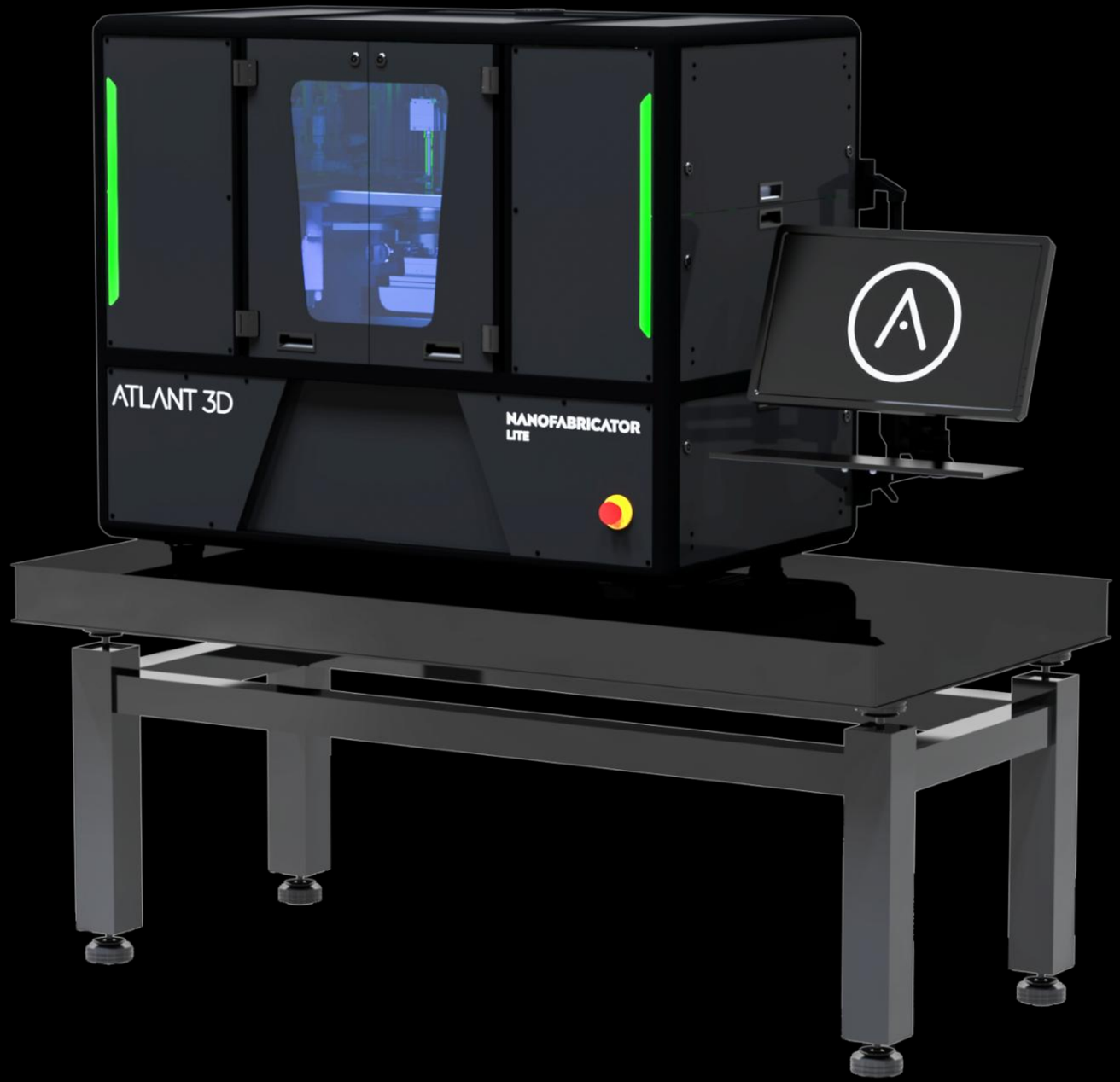
The iterative process, the operational complexity and the number of human errors

- limit the speed of discovery, reliability of data and design possibilities.

INTRODUCING NANOFABRICATOR™ LITE, SHRINK AND AUTOMATE THE INFRASTRUCTURE

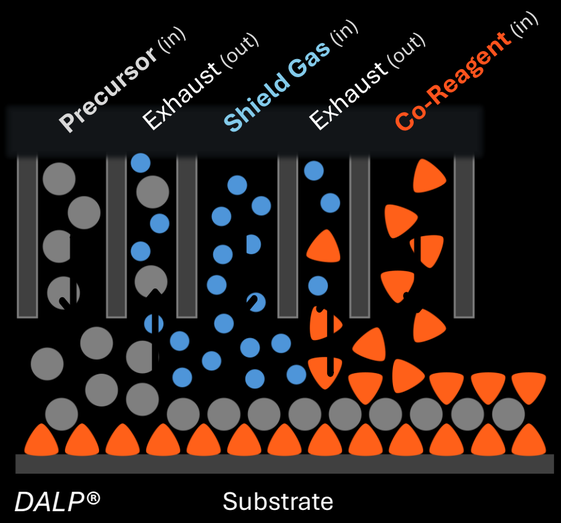
- Providing a swift path through the parameter space in material science and device prototyping.

- Utilising our patented technology, Direct Atomic Layer Processing®, the NANOFABRICATOR™ Lite radically accelerates your R&D, while reducing cost, complexity, error, and waste.



DALP® - HOW IT WORKS

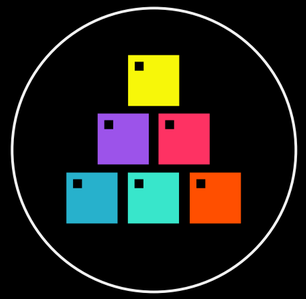
Innovation in spatial ALD, enabling the transition from Macro to Micro scale.



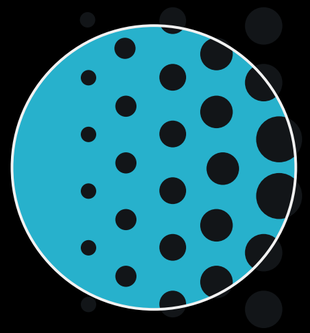
ADVANTAGES OF ALD-BASED PROCESSING

NANOFABRICATOR™ Lite

Innovation in spatial ALD, enabling the transition from Macro to Micro scale.

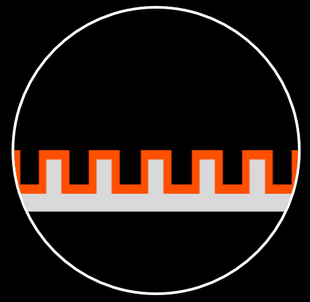


VERSATILE MATERIALS PLATFORM
Possibility of 450+ materials.



CONTROL OF MATERIAL MICROSTRUCTURE
From 6 nm nanoparticles to 1 cm^2 fully dense pinhole-free layers passing by nanoporous layers.

ALD-BASED



CONFORMALITY TO SUBSTRATE GEOMETRY
Processing on 90° walls and conformal coatings in cavities and around nanostructures.
Currently available: 60 microns depths conformal coatings

ATLANT 3D

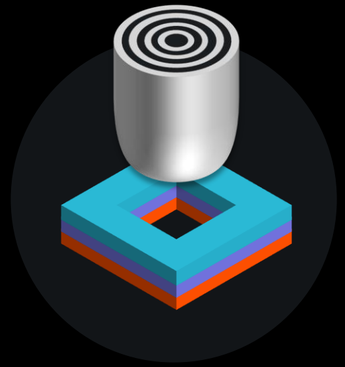
DIRECT WRITE ATOMIC LAYER DEPOSITION
Local growth of materials, **with ALD quality**.

OUR UNIQUE ADVANTAGES

NANOFABRICATOR™ Lite

ARBITRARY PARAMETERS GRADIENTS

Multidirectional linear, quadratic and exponential growth over a gradient, for a broad range of variables.
Minimal step height of 0.3 nm, minimal step width of 2 microns.



MULTIMATERIAL STACK PRINTING

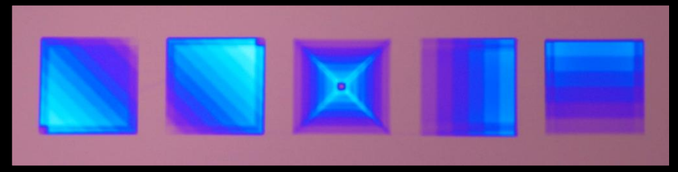
Multiple materials can be deposited sequentially in the same chamber to create multilayer structures such as Bragg mirrors, MIM capacitors or diodes.

ARBITRARY PARAMETERS GRADIENTS

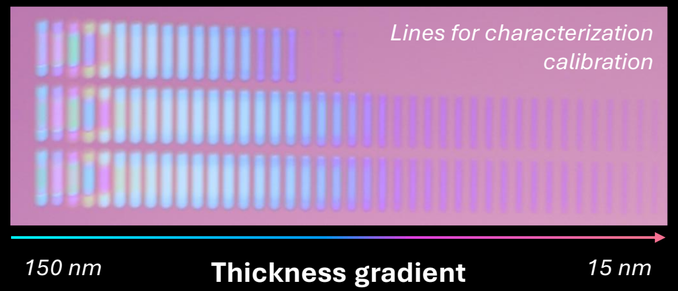
Multidirectional linear, quadratic and exponential growth over a gradient, for almost any variable.
Minimal step height of 0.3 nm, minimal step width of 2 microns.

Use **gradients** to create data-rich experiments for device design. Our technology provides the freedom to control:

- Geometry
- Materials
- Thickness
- Composition
- Microstructure
- Step density
- Raster density

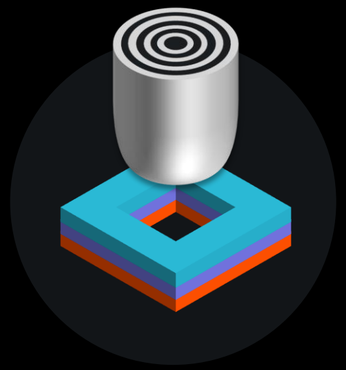


Geometry (step layers)



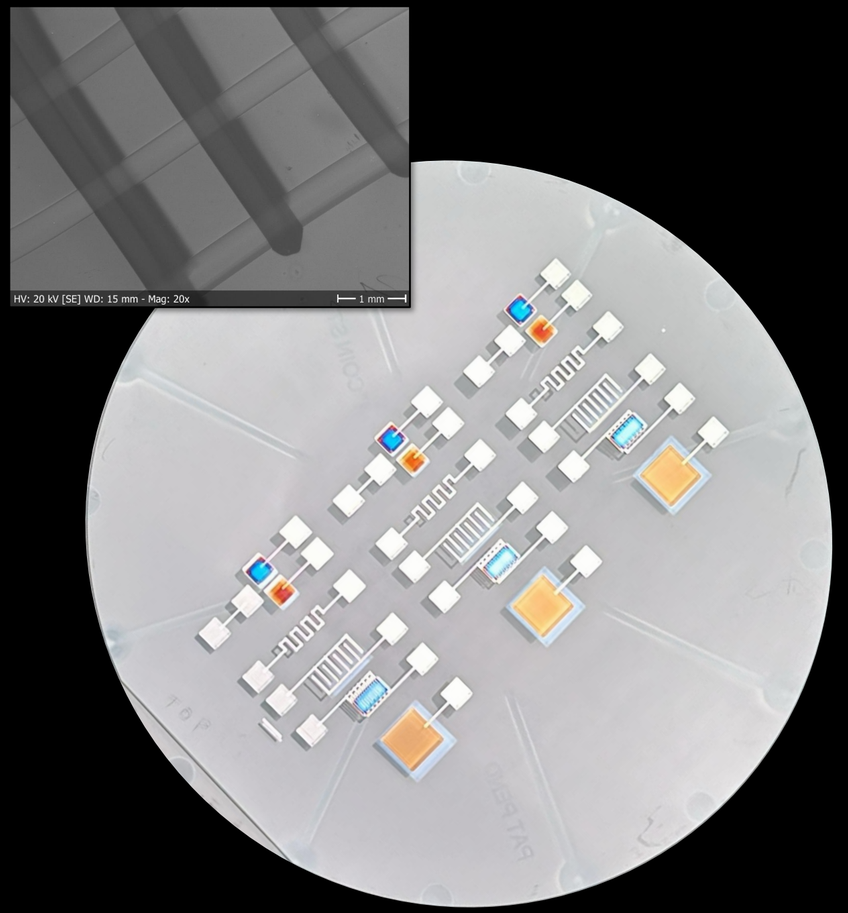
Thickness raster

Materials



MULTIMATERIAL STACK PRINTING

Multiple materials can be deposited sequentially in the same chamber to create multilayer structures such as Bragg mirrors, MIM capacitors or diodes.



Discover new process steps and optimize material stacks.

Integrate with standard processes (Electroplating, Etching).

Locally functionalize (Encapsulation, Nanoparticles deposition).

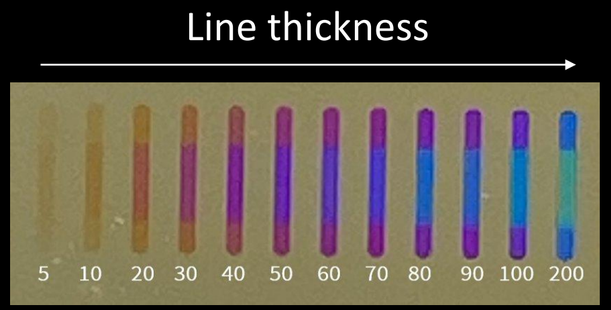
Create Novel devices:

Innovative devices: Material gradients, Mosaic elements, etc.

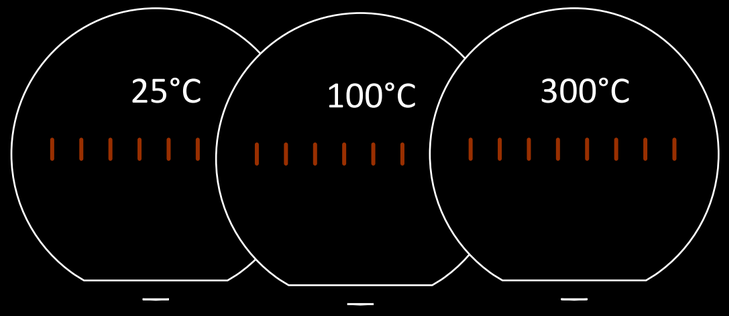
Novel integration paths: Vertical devices, vertical interconnects.

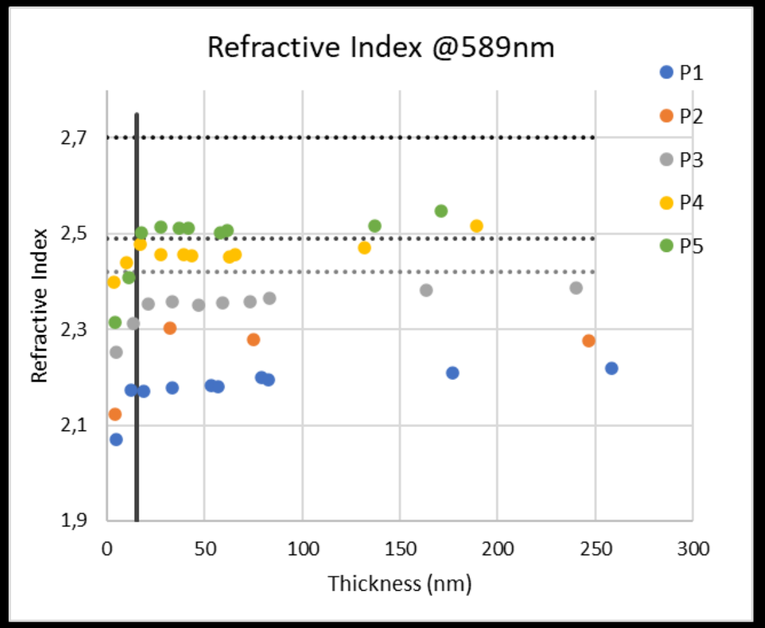
MATERIAL OPTIMIZATION – OPTICAL PROPERTIES

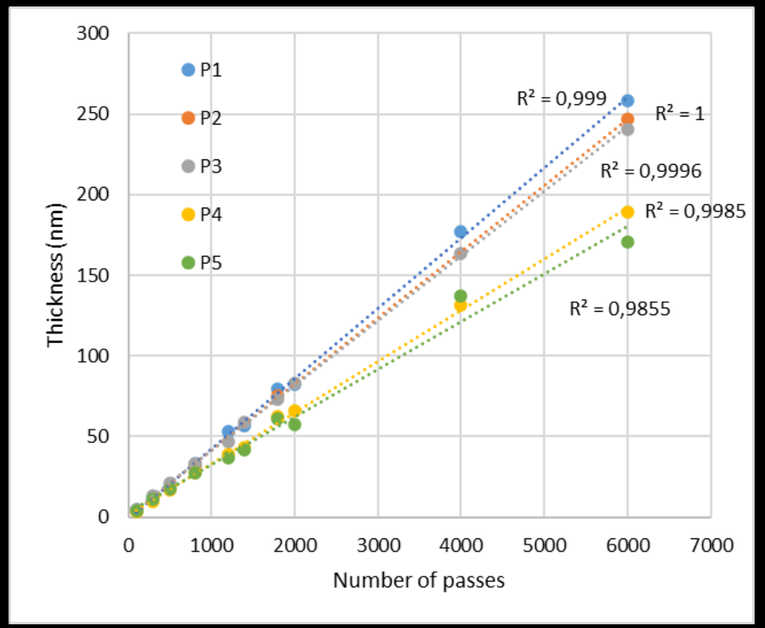
- THICKNESS-VARIATION



TEMPERATURE-VARIATION



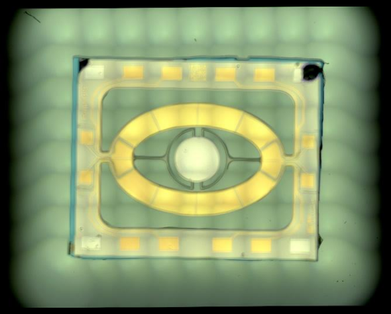


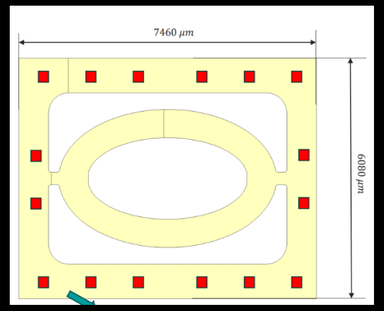


50 data points generated in **5 hours, swift discoveries in material science**

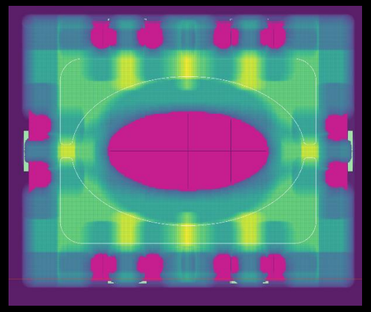
MEMS DEVICE ENCAPSULATION

Chip

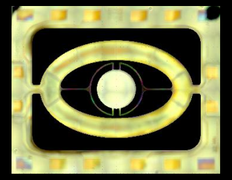




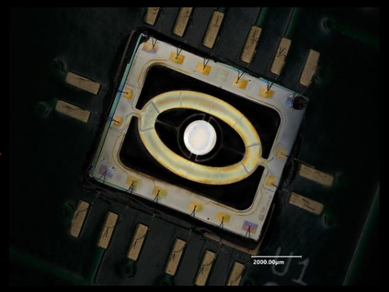
Design request



Deposition Preview with ATLANT 3D software



Deposition result



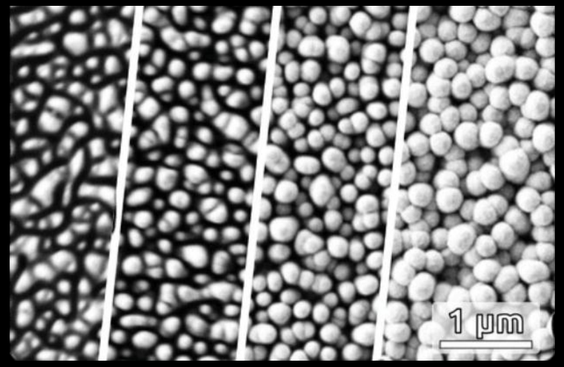
Working at customer site

HIGHLIGHTS

- Delicate suspended micromirror on a 8x6 mm frame, provided by Silicon Austria Labs
- Challenging geometry with forbidden zones (no deposition on central mirror structure or bonding pads)
- DALP® deposition by ATLANT 3D of TiO_2 layer protecting sensitive device areas, confirmed by EDX elemental analysis
- Electrical and optical tests show that DALP® deposition does not affect target device performance after encapsulation

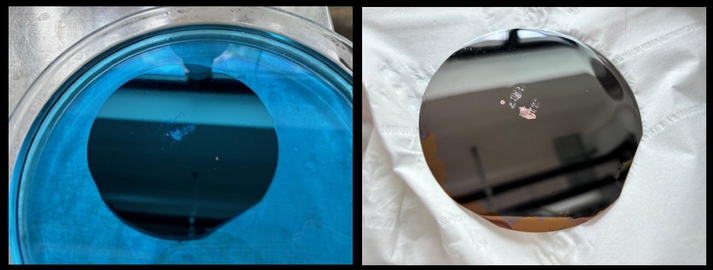
Integrate and develop with standard process flows

Functionalization of nanostructures and electrodes



Surface functionalization for gas sensors.
Metal oxide decoration with noble metals and metal oxides for enhanced gas analyte sensing

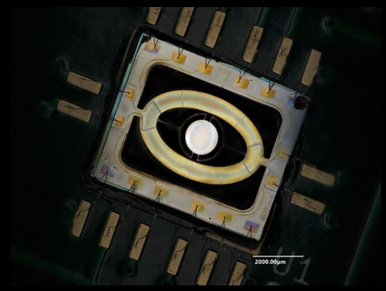
Seed layers for metal plating



Conductive seed layers for electroless plating of solar cell top contacts

Electroless plating of Cu is feasible even on very thin Pt depositions of
5 nm or less

MEMS and waveguide encapsulation



MEMS Encapsulation

TESTIMONIALS

“We are excited to leverage the unprecedented capabilities of the ATLANT 3D Nanofabricator Lite (NFL) to explore atomic-scale engineering ***of complex thin-film materials and interfaces.*** *This cutting-edge tool will play a pivotal role in advancing our research into next-generation batteries, materials for analog neuromorphic computing, high-power GaN electronics, and active layers for perovskite solar cells, pushing the boundaries of what’s possible in material science and device innovation.”*

Alexander C. Kozen,
Assistant Professor, Dep. Of Physics

The University of Vermont

“ATLANT 3D’s ***DALP technology completes our inkjet process by enabling precise, localized conformal functionalization of nanostructures and MEMS with metals and metal oxides****. This capability allows us to integrate multiple materials into a single sensor platform, significantly boosting the performance and detection capabilities of our electrochemical sensors, making it an essential component of the sensor technology solutions developed in AMUSENS.”*

Renaud Leturq, Lead R&T Associate at LIST,
Coordinator of AMUSENS EU Project

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

"ATLANT 3D’s direct deposition capabilities have allowed us to overcome the design constraints of lithography, creating novel device designs for electronic devices and sensors, even on complex surfaces. The integration of multiple materials in a single sensor platform has vastly improved our capabilities, making it an invaluable asset in our research.“

Boris Hudec, Scientific Researcher, Institute of Electrical Engineering, Slovak Academy of Sciences

IEE SAS INSTITUTE OF ELECTRICAL ENGINEERING SAS

SONY NASA MERCK esa life.augmented WEST HILL Innovationsfonden European Commission