‘Optical Manufacturing services for Metalenses and Metaoptics’

Gauthier Briere, PhD

Product Marketing Manager

EPIC Online Technology Meeting on Metamaterials and Metalenses

APPLIED MATERIALS®
make possible

Founded in 1967

55 YEARS MAKE POSSIBLE

World's #1

Semiconductor and Display Equipment Company

$23.06 billion
revenue
TOTAL FISCAL 2021

$2.5 billion
R&D spending

~15,700
patents

~27,000
employees
in **19** countries

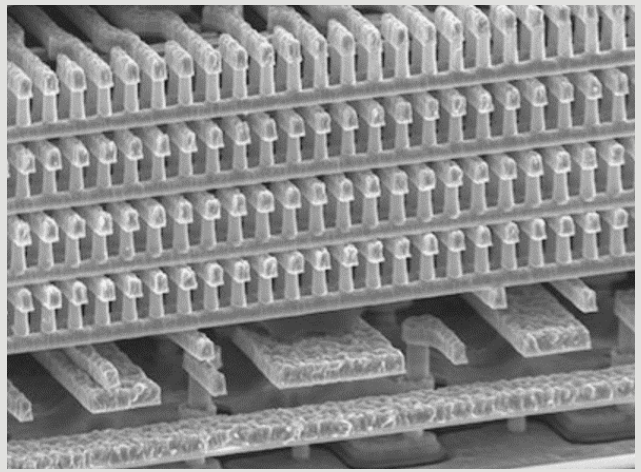
Data as of fiscal year end, October 31, 2021

APPLIED MATERIALS

Engineered Optics Group makes Optical Devices

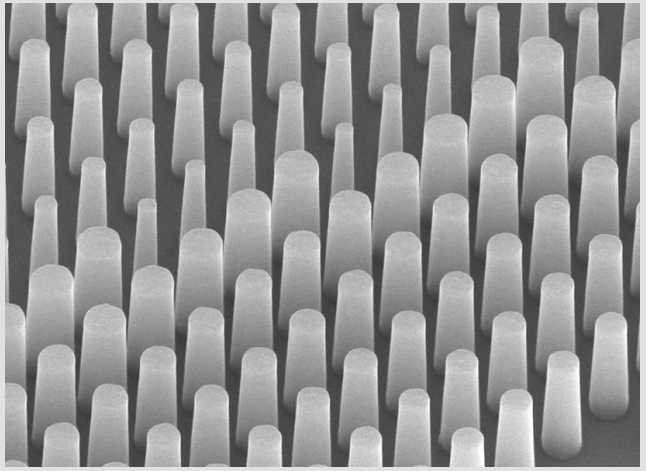
» Flexible materials engineering capability

Semiconductor



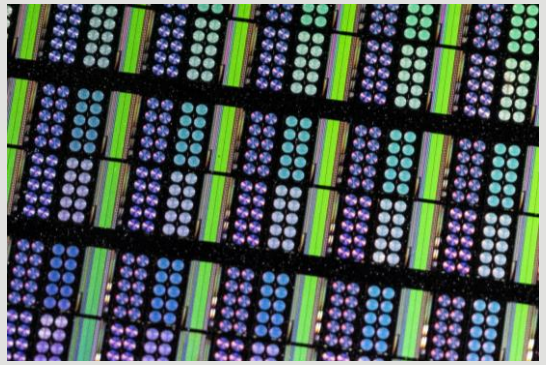
Nanostructures Manipulating **Electrons**

Engineered Optics

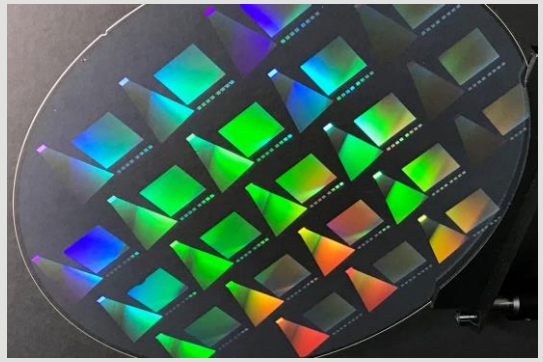


Nanostructures Manipulating **Photons**

Scaled by Applied Materials…



NIR Lenses



Waveguide Combiners

Leveraging our 50 years of experience

Optical device performance	New materials, precise control of material optical properties & critical dimensions & shapes
Exotic transparent substrates	Customized equipment & process
Yield, cost	Mature & proven 300mm wafer processing

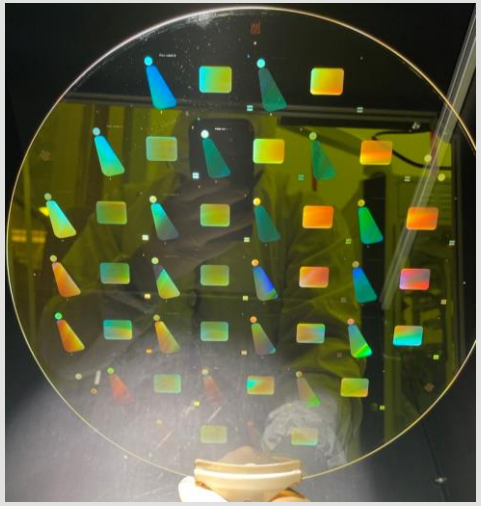
EO Initial Product Focus

Waveguides for AR Glasses

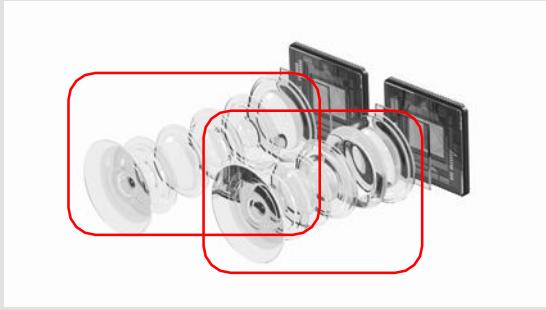
Example only

Example only

Etched Waveguides on 300mm Transparent Substrate

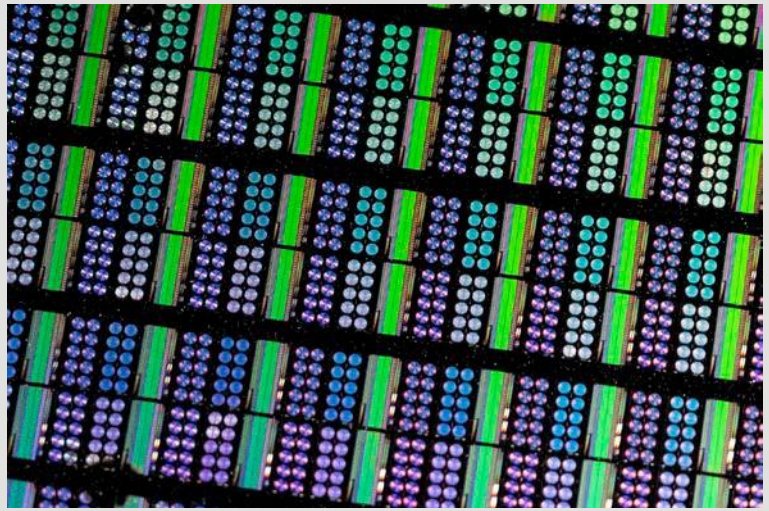


Flat Lenses for Near Infra-red



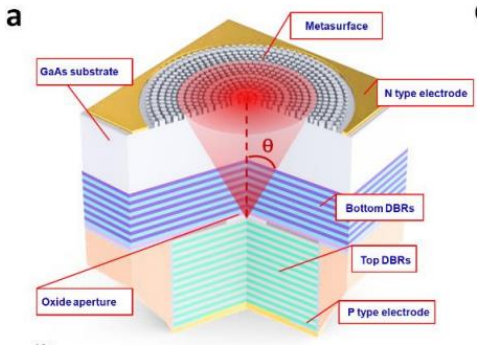
Examples only

IR Lenses on 300mm Transparent Substrate



Why meta-optics? And Are we over the Death Valley/Trough of Disillusionment?

- Polarization control
- Local Phase engineering
- Amplitude control
- Thinner
- Multi-functional
- Compatible with semiconductor nanofabrication process

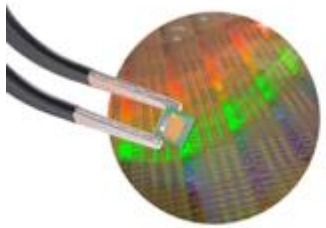


Xie, YY., Ni, PN., Wang, QH. et al.Nat. Nanotechnol. 15, 125–130

Zhang, F., et al Adv. Mater. 2021, 33, 2008157.

Top 10 Emerging Technologies 2019

WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD



Metalenz and STMicroelectronics deliver world's first optical metasurface technology for consumer electronics devices

The World's First Metasurfaces Have Arrived.

metalenz

NEWS RELEASE 22-DEC-2022

Meta-Optics: the disruptive technology you didn't see coming

Peer-Reviewed Publication

ARC CENTRE OF EXCELLENCE FOR TRANSFORMATIVE META-OPTICAL SYSTEMS

Metaoptics for the consumer market

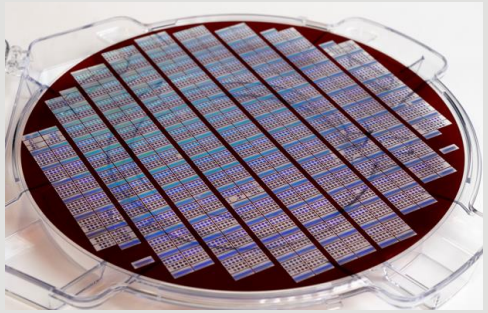
Giampaolo Pitruzzello

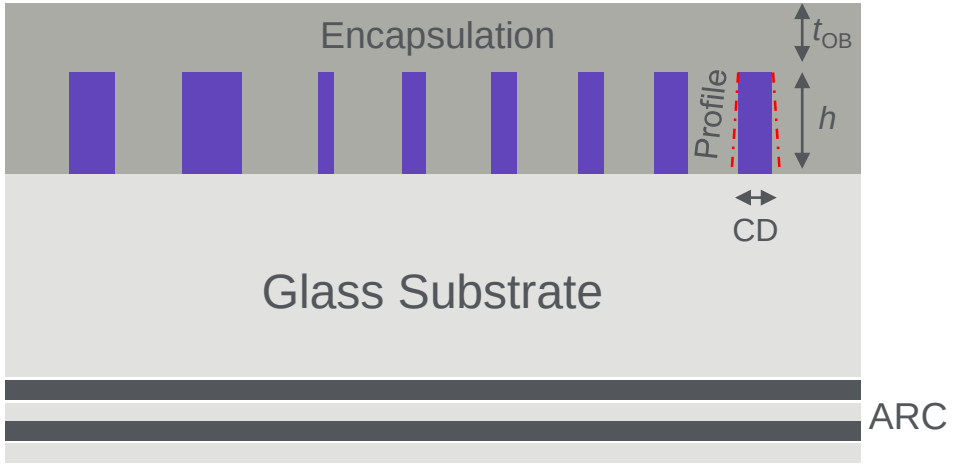
Nature Photonics **17**, 6–7 (2023) | Cite this article

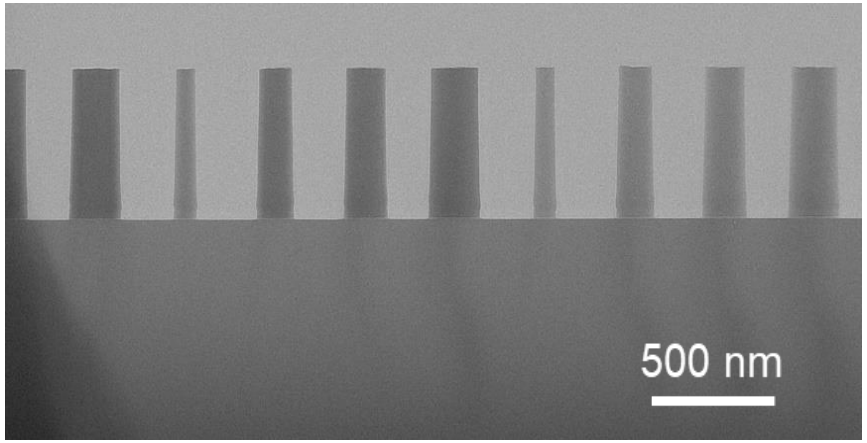
APPLIED MATERIALS

Metaoptics, a closer look

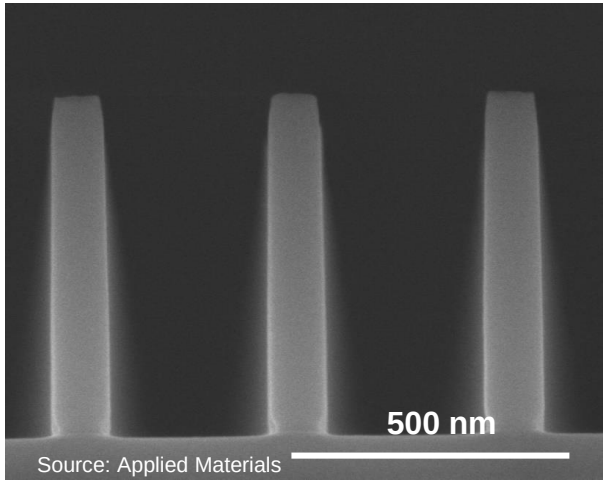
10's to 10k lens/devices per wafer



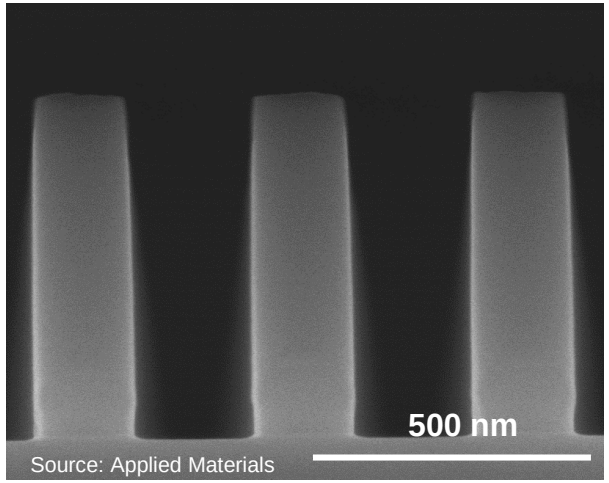




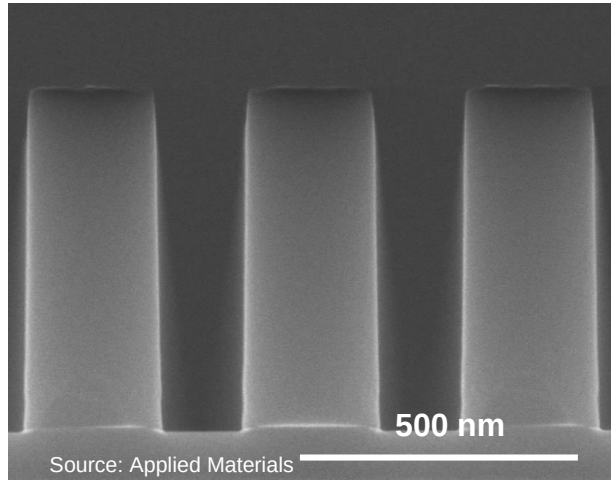
Small size pillar



Medium size pillar



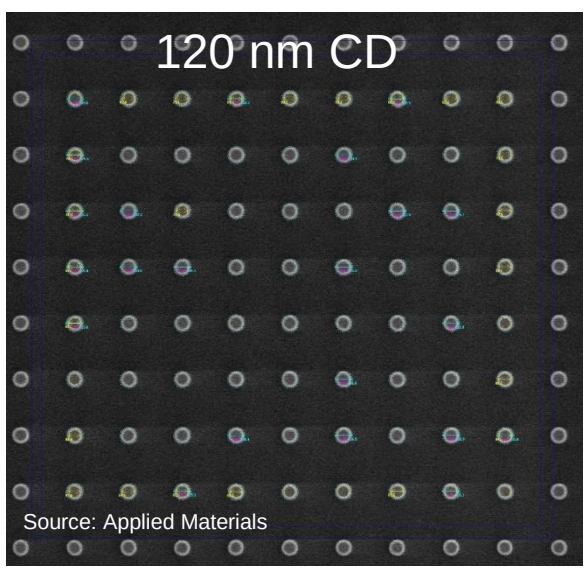
Large size pillar

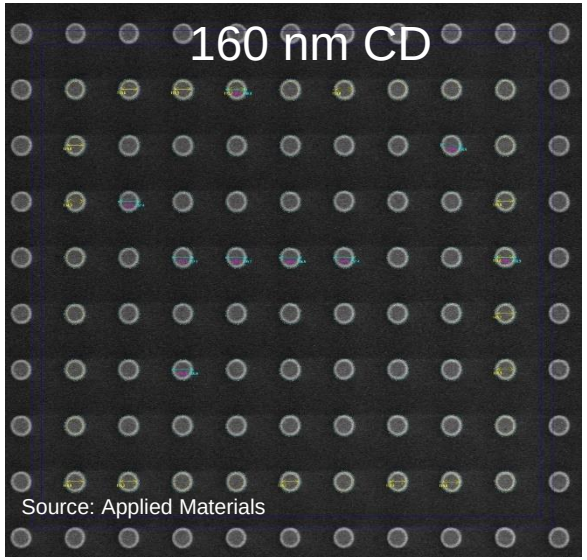


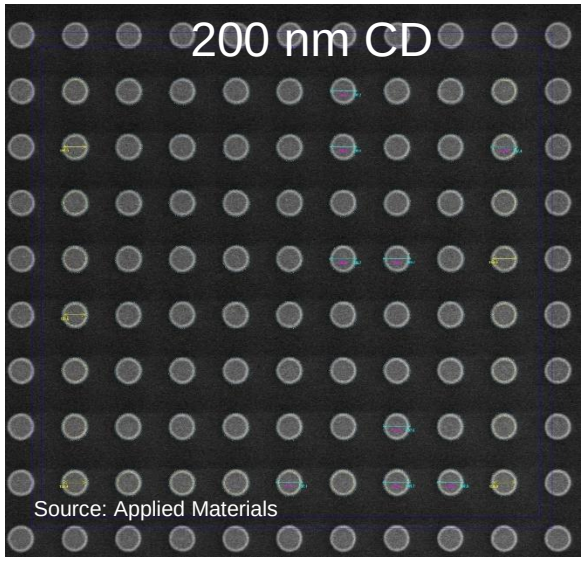
Sidewall angle > 88° across the design rule CD range can be well controlled.

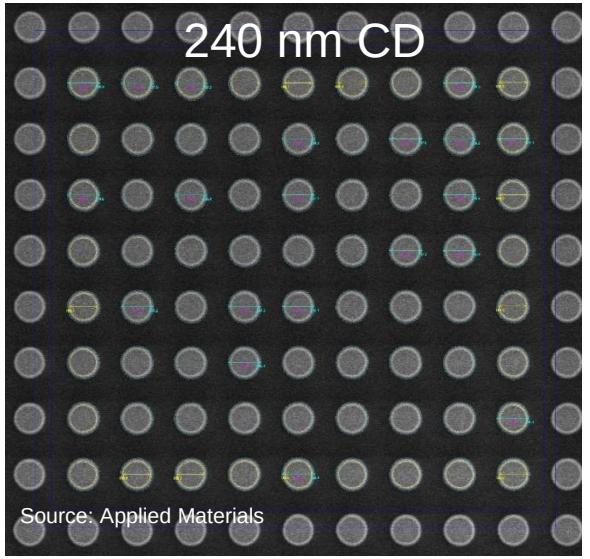
APPLIED MATERIALS

Pillar Full-Wafer CD Uniformity Control



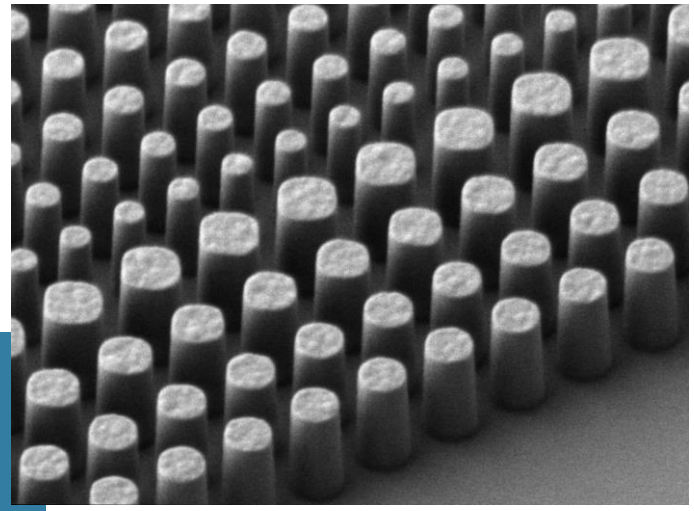






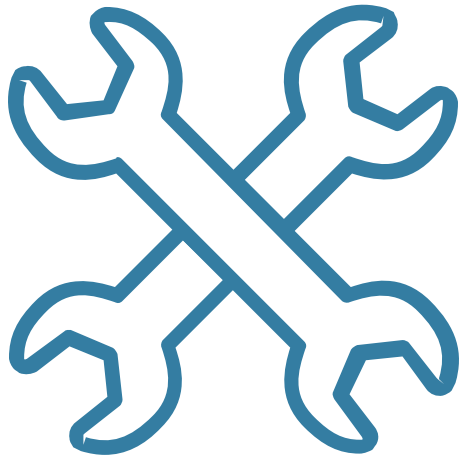
Full wafer 3-σ: 9.5 nm (8%)	Full wafer 3-σ: 7.1 nm (4%)	Full wafer 3-σ: 9.7 nm (5%)	Full wafer 3-σ : 11.4 nm (5%)

CDU Full wafer 3σ <12 nm is achieved across the design-rule CD range



Bring your idea

And let’s collaborate!



Come talk to us at SPIE Photonic West – San Francisco

From semiconductor industry leader to optical engineering pioneer

31 January 2023 • 3:00 PM - 3:20 PM PST

Add to My Schedule