

High precision polymer injection molding in Micro Optics

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Sony DADC - PART OF THE SONY GROUP CORPORATION

SONY

SONY GROUP CORPORATION

Kenichiro Yoshida
CEO



Games & Network Services | Music | Pictures | Entertainment Technology & Services | Imaging & Sensing Solutions | Financial Services | New Initiatives

Sony DADC

Sony DADC GLOBAL

Dietmar Tanzer
President Sony DADC Global



Sony DADC



THALGAU, AT



PILSEN, CZ



TERRE HAUTE, US

1983

ORGANISATION
ESTABLISHED

900

GLOBAL
EMPLOYEES

CD, DVD, BD, UHD

CONTRACT
MANUFACTURER

26.4 Billion

PRODUCTS
IN 40 YEARS

Sony DADC AUSTRIA – THALGAU MANUFACTURING CAMPUS



Area size: 51,191 sqm
Building footprint: 16,062 sqm
Used floor space: 41,750 sqm
Building dimension: 140 x 115 m



CLEANROOM ENVIRONMENT

Flexible adaption according to actual demand

- › ISO 6 cleanroom: 500 sqm
- › ISO 7 cleanroom: 6,000 sqm
- › Useable height: 3 m
- › 20 air handling units
- › Air exchange rate: 40-80 per hour
- › Temperature & humidity controlled
- › Exhaust air for different quality fractions

STATE OF THE ART FAB INFRASTRUCTURE - DISC

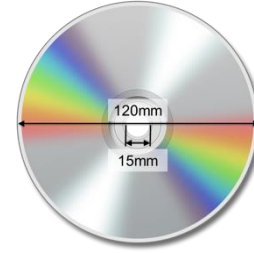
ONE-STOP SHOP SOLUTION



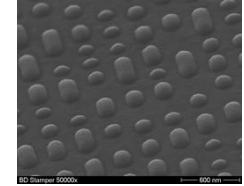
HIGH-PRECISION MICRO AND NANOTECH POLYMER SOLUTIONS



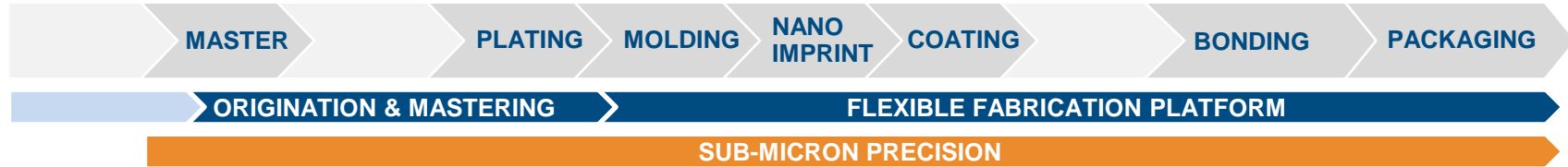
Disc Generations



Disc Shape



PIT length: 150 to 600 nm
PIT depth: 80 nm
PITCH track: 320 nm



BRIGHT VISIONS

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STATE OF THE ART FAB INFRASTRUCTURE – MICRO OPTICS

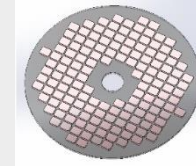
ONE-STOP SHOP SOLUTION



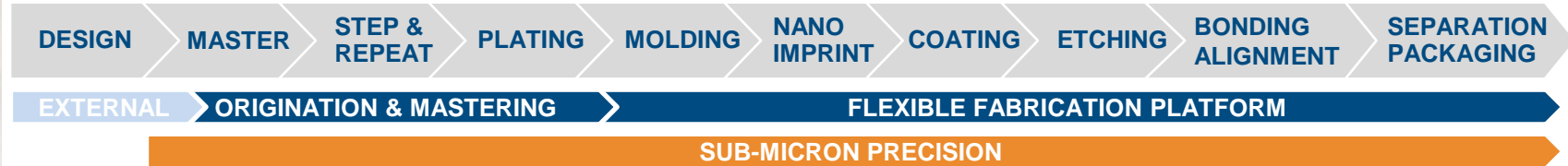
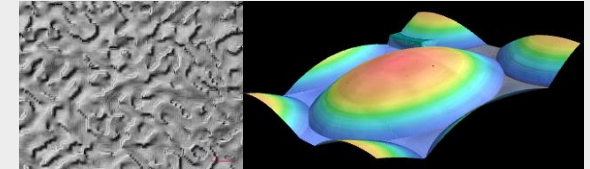
Optical Elements

- ROE - Refractive Optical Elements
- DOE - Diffractive Optical Elements
- MOE - Meta Optical Elements

Wafer Level Optics



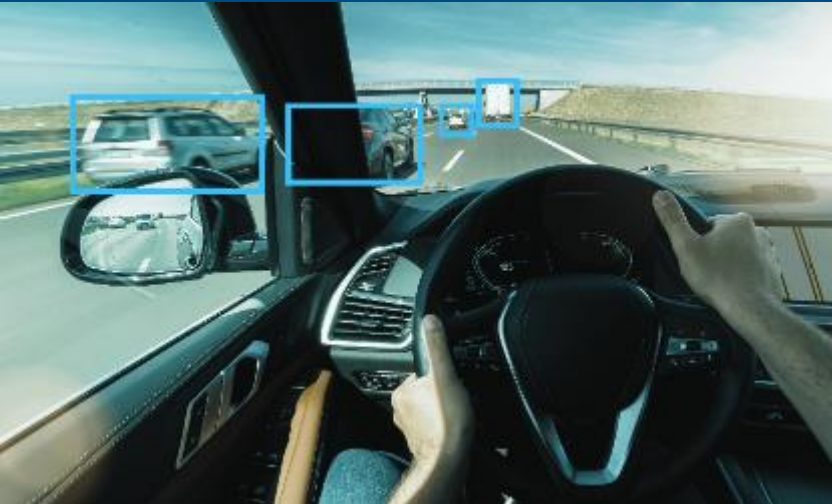
Surface structure 50 nm up to 100.000 nm



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DEVELOP A UNIQUE POLYMER FABRICATION PLATFORM FOR MICRO OPTICS



SENSING TECHNOLOGY



LIGHTING SOLUTIONS



CONSUMER ELECTRONICS

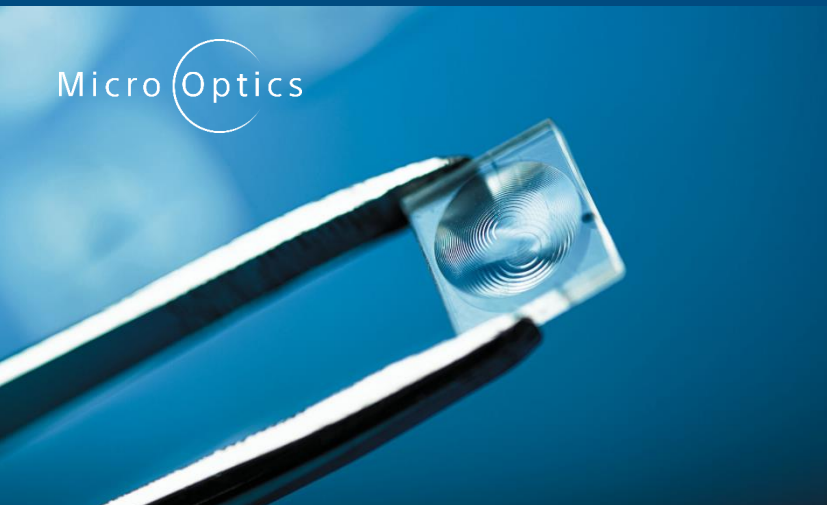
PRIMARY FOCUS

POLYMER SOLUTIONS

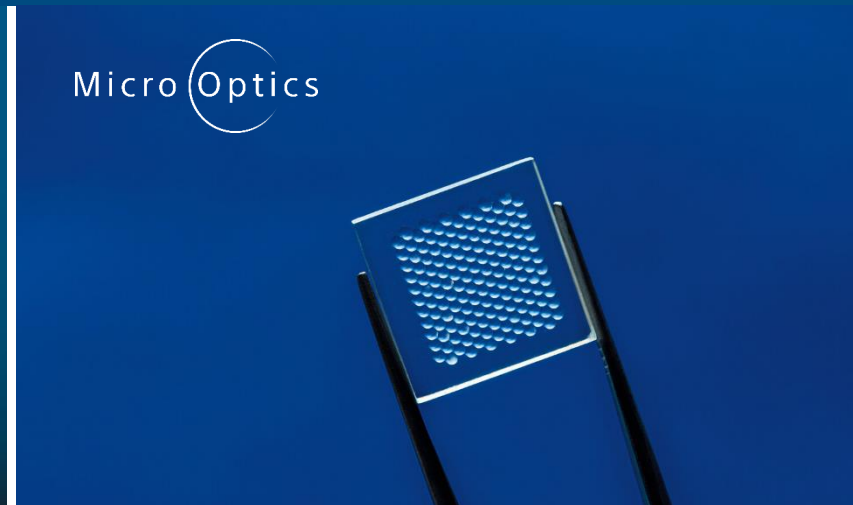
VOLUME FABRICATION

DEVELOPMENT

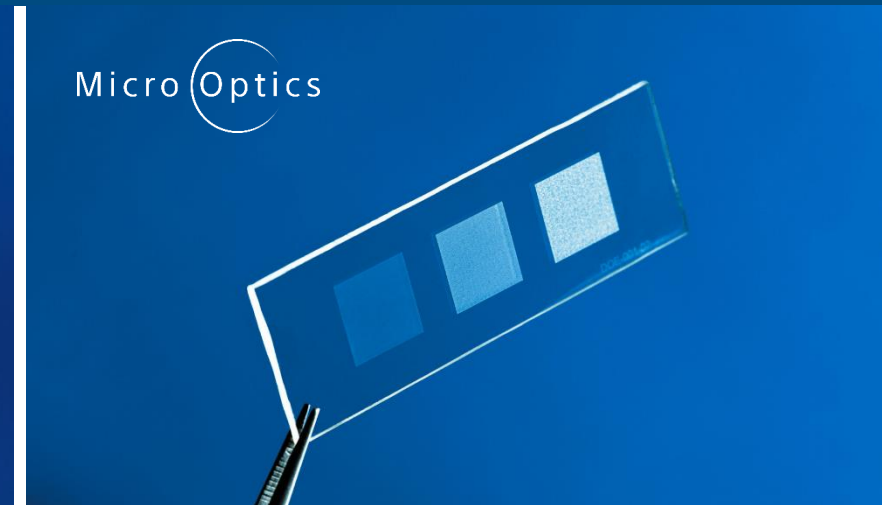
PROTOTYPES IN COOPERATION WITH PARTNERS & RESEARCH INSTITUTES



FRESNEL



MLA



DOE

NEW INITIATIVES

Amongst others we cooperate with:



POLYMER OPTICAL PROPERTIES



POLYMER SUBSTRATE

**Polymers share optical
properties of glass**

- **Cost Efficiency:**
Significant savings in high-volume production
- **Affordable Materials:**
Lower-cost thermoplastic polymers
- **Design Flexibility:**
Easily replicate complex shapes
- **Efficient Production:**
Faster cycle times and increased productivity
- **Robust Production:**
Stable, repeatable, qualitativ
- **Lightweight:**
Reduces overall weight of assemblies
- **Thermal Stability:**
Matched thermal expansion between wafer and lenses reduces delamination risks

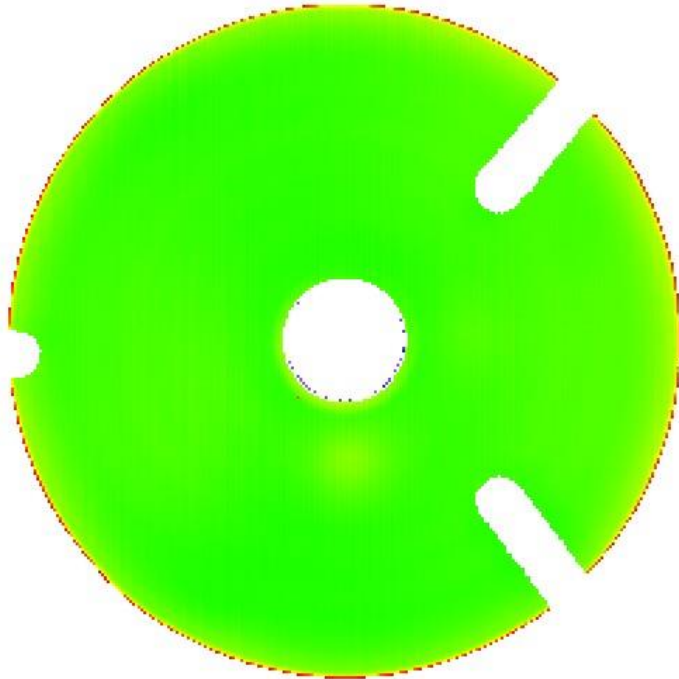
POLYMER INJECTION MOLDING



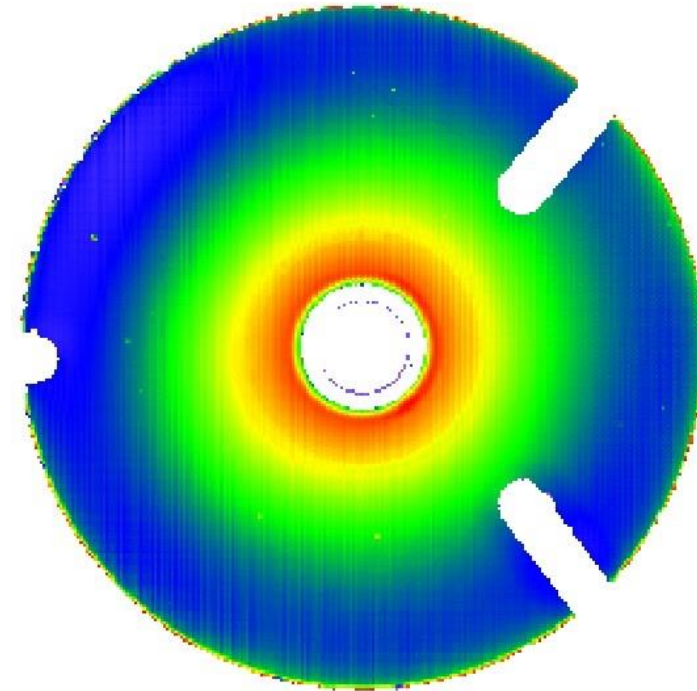
**Hi-speed , Hi-precision optical polymer
Injection molding is a key expertise at Sony DADC**

THICKNESS DISTRIBUTION

Micro Optics Polymer Wafer
TTV = 5 μm

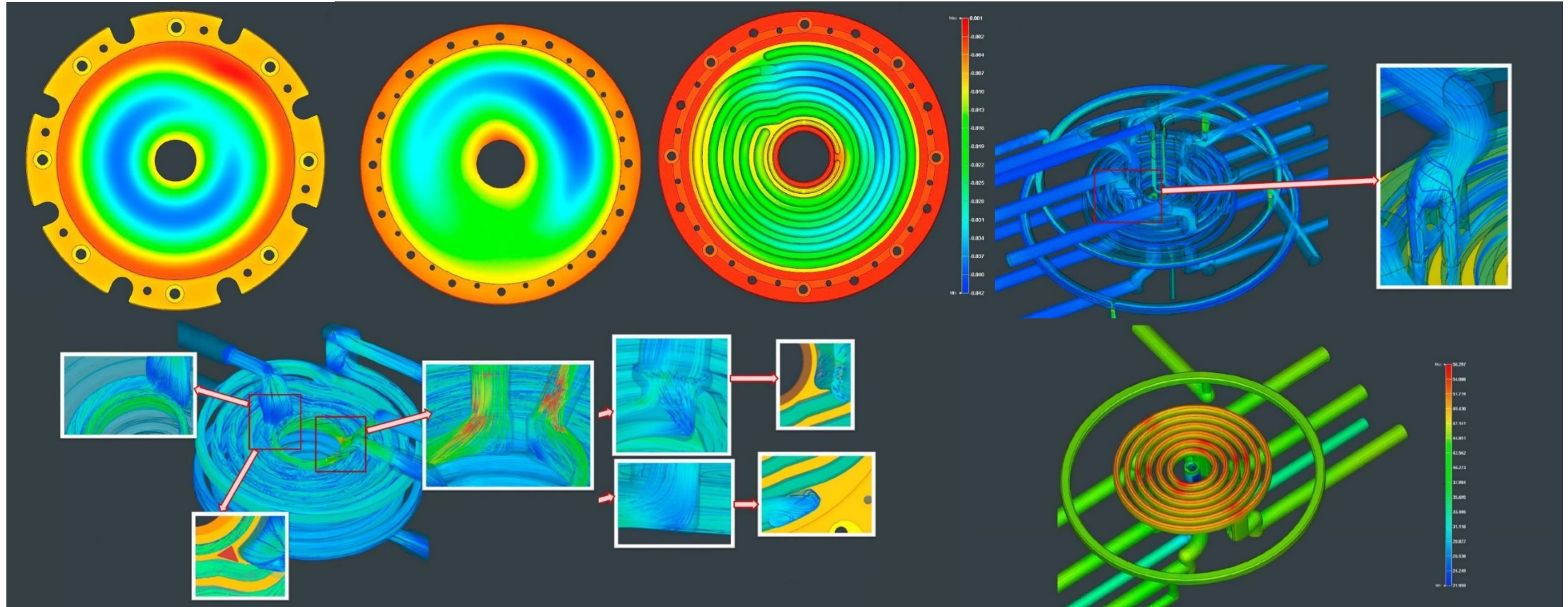


Optical Polymer Disc
TTV = 40 μm



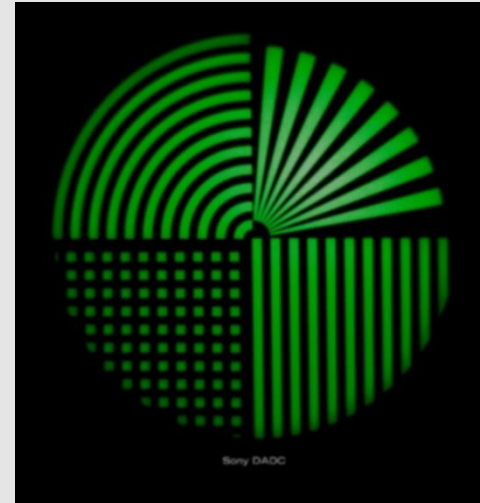
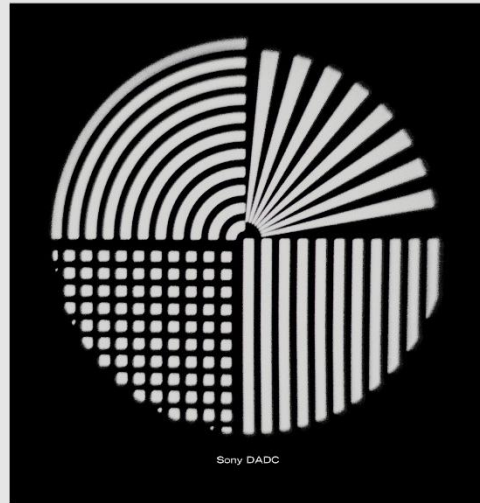
A very good total thickness distribution of our Micro Optics Polymer Wafer is the base for multiple optical applications

THICKNESS DISTRIBUTION



Achieving a very good thickness distribution by thorough analyses, simulations, and process development, e.g. cooling channels, mold deformation, temperature distribution, clamping profile

WIDE RANGE OF APPLICATIONS IN VISIBLE AND INVISIBLE WAVELENGTH



POLYCARBONATE (PC)
is the polymer for optical discs

POLYMETHYLMETHACRYLATE (PMMA)
is a synthetic polymer

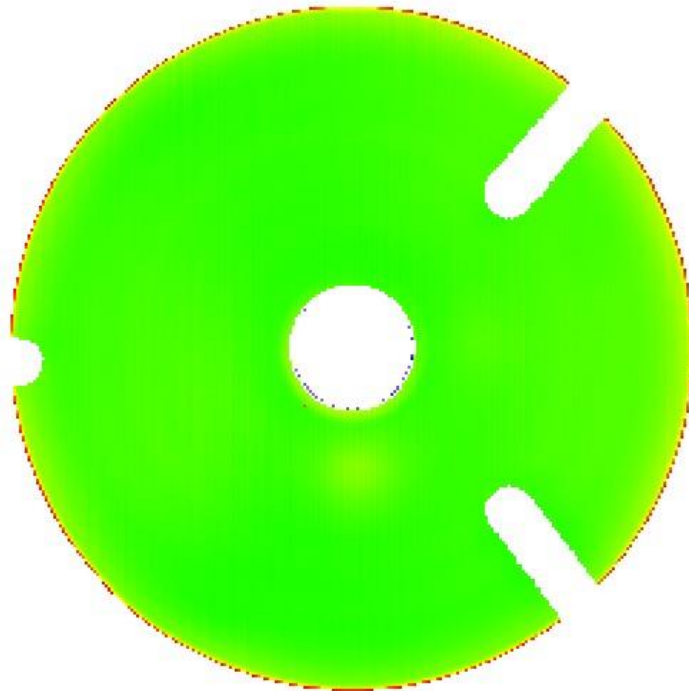
CYCLO OLEFIN COPOLYMER (COC)
is an amorphous polymer

CYCLO OLEFIN POLYMER (COP)
is a top-tier specialty polymer

MULTIPLE OPTICAL APPLICATIONS

Micro Optics Polymer Wafer

TTV = 5 μm

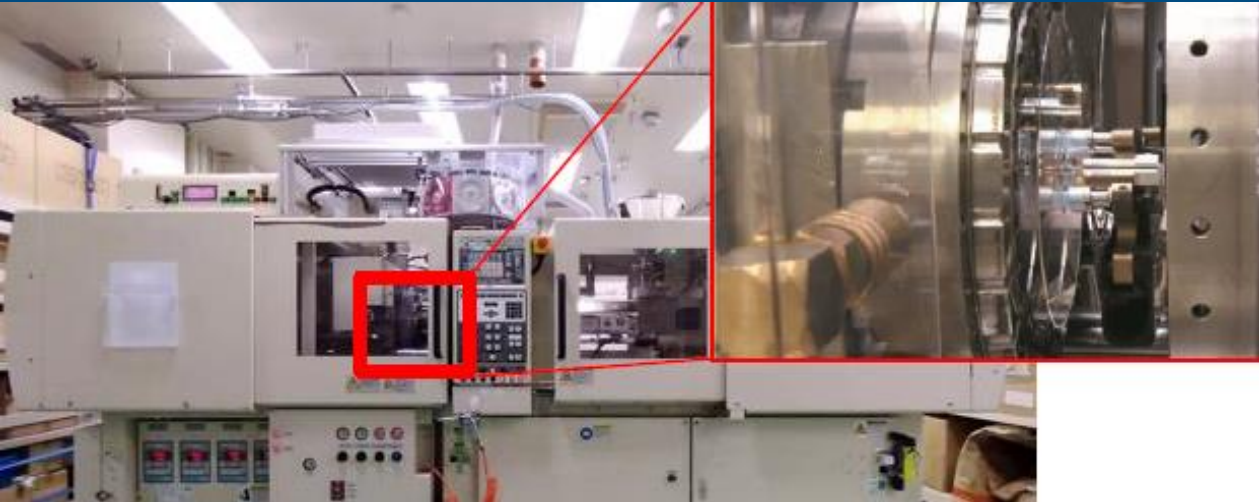


Fully populated wafer with MLA, Fresnel, DOE



A very good total thickness distribution of our Micro Optics Wafer and various Injection Polymers is the base for multiple optical applications in wafer level optics (ROE, DOE)

INJECTION MOLDING PROCESS HAS A GREAT POTENTIAL FOR HIGH ASPECT RATIO PLASTIC METALENS MASS-PRODUCTION



INJECTION MOLDING PROCESS

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- **Optimized Injection conditions** for melt and mold temperatures improving filling rate without polymer degradation.
- Proper temperature control and surface treatment of the **Ni stamper** achieving a very good transcription rate
- **A Thermoplastic Metalens** with a multi height structure - 300 to 1100 nm, RI 1,67 - was successfully fabricated by **Injection Molding**

INJECTION MOLDING PROCESS HAS A GREAT POTENTIAL FOR HIGH ASPECT RATIO PLASTIC METALENS MASS-PRODUCTION

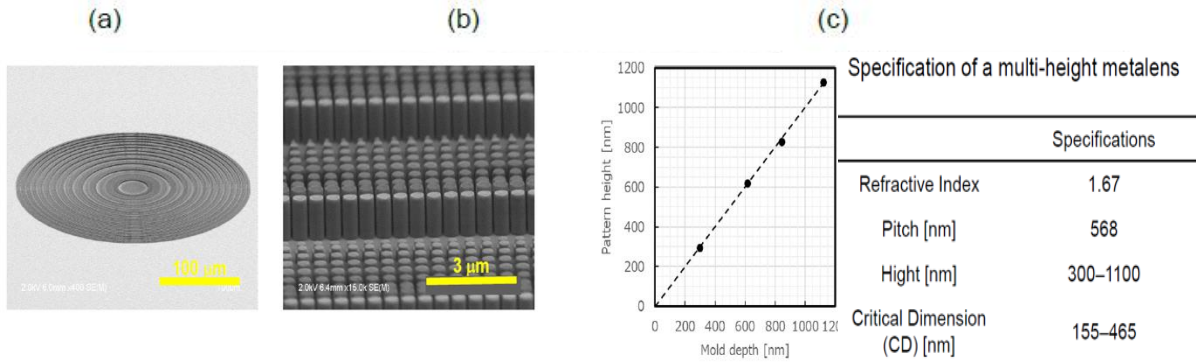


Figure 6. The SEM images of the injection molded test lens with multi height patterns (a; whole lens, b; multi height pillars). (c) Relation between the mold depth and the injected pattern height measured by AFM.

Ref: [Proc. SPIE 12653, Nanoengineering: Fabrication, Properties, Optics, Thin Films, and Devices XX, 126530E \(3 October 2023\)](#)

Injection Molding process is one of the most productive techniques having great potential to fabricate nanostructures rapidly and efficiently in large numbers

RESULTS:

“It was found to mold nanostructures with an aspect rate of 12:1 is possible.”

“The focal length of the molded metalens showed matching with the simulated value.”

“The results show the possibility of mass production with high throughput using the Injection molding process for plastic metalens.”

INJECTION MOLDING PROCESS

BRIGHT VISIONS

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Sony DADC AS PARTNER TO ENHANCE MICRO OPTICS TECHNOLOGY IN POLYMER

WE OFFER

POLYMER SOLUTIONS INSTEAD OF EXISTING GLASS SOLUTIONS
PROTOTYPING & MASS FABRICATION MADE IN EUROPE
DEVELOPMENT & PROCESS ENGINEERING TEAM

WE ARE ON THE LOOKOUT

TECHNOLOGY EXCHANGE (PROCESSES, MATERIAL, METROLOGY, ...)
TECHNICAL SPECIFICATIONS FOR USE CASES IN PRIMARY MARKET SEGMENTS
PARTNERS FOR DEVELOPMENT PROJECTS AND MASS PRODUCTION IN POLYMER

Sony DADC

Micro Optics



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Thank you!