

# EVG SmartNIL<sup>®</sup> Technology for Patterning Requirements of More than Moore Applications

Dr. Martin Eibelhuber

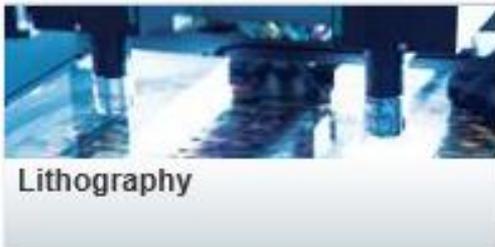
- Introduction
- SmartNIL<sup>®</sup>
- Application Focus
- Inspire

EVG is a global supplier of:

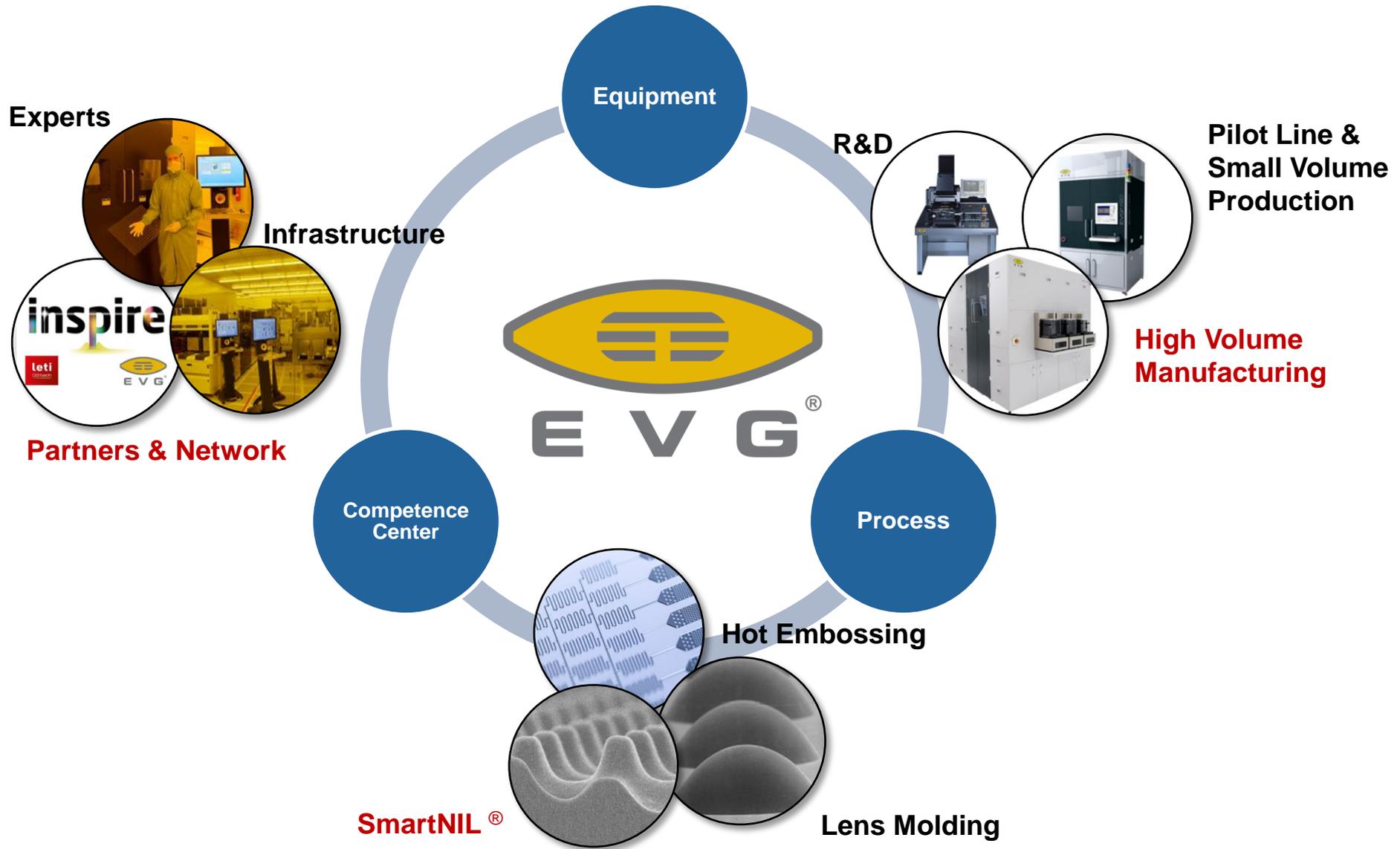
- Wafer Bonders
- Mask Aligners
- Coaters / Developers / Cleaners
- Temporary Bonders / Debonders
- Inspection / Metrology Systems
- **Nanoimprint Lithography System**



EV Group holds the dominant share of the market for wafer bonding equipment and is a technology leader in lithography for advanced packaging and nanotechnology.



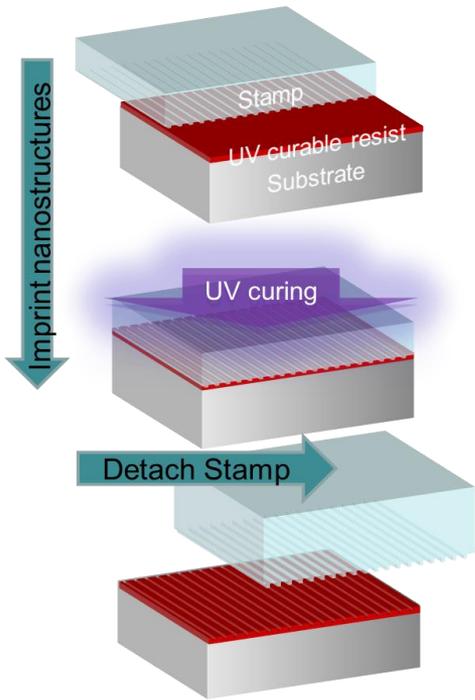
# Nanoimprint Lithography at EVG



# Nanoimprint Lithography at a Glance

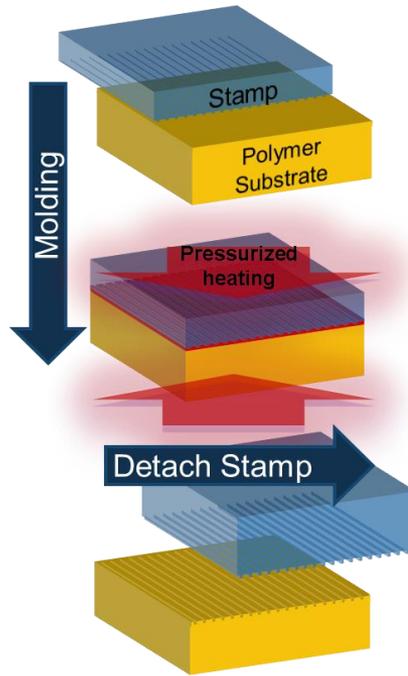


## SmartNIL (UV-NIL)



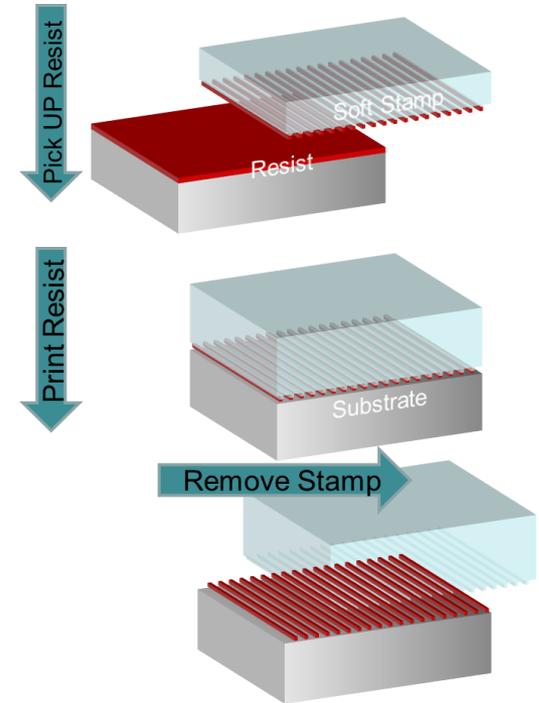
UV curing polymers with photo initiator

## Hot Embossing



Thermoplastic materials; bulk polymer or spin-on

## Micro Contact Printing (μCP) Soft Lithography



(Bio-) Functionalized materials and glues

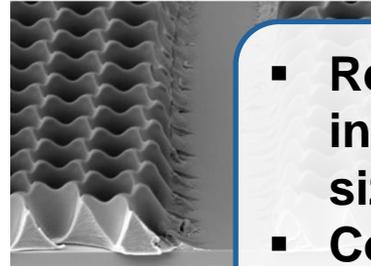
# Unique Benefits of Nanoimprint

## Large Area Nanopatterning



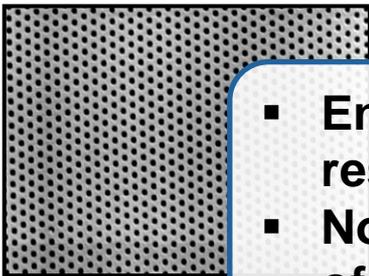
- Wafer level processing of nanostructures without stitching
- Scalable technology which not limited by an optical system

## 3D Patterning



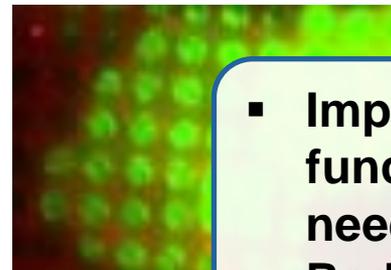
- Replication process is insensitive to shape, size & structure
- Complexity does not add manufacturing costs

## High Resolution



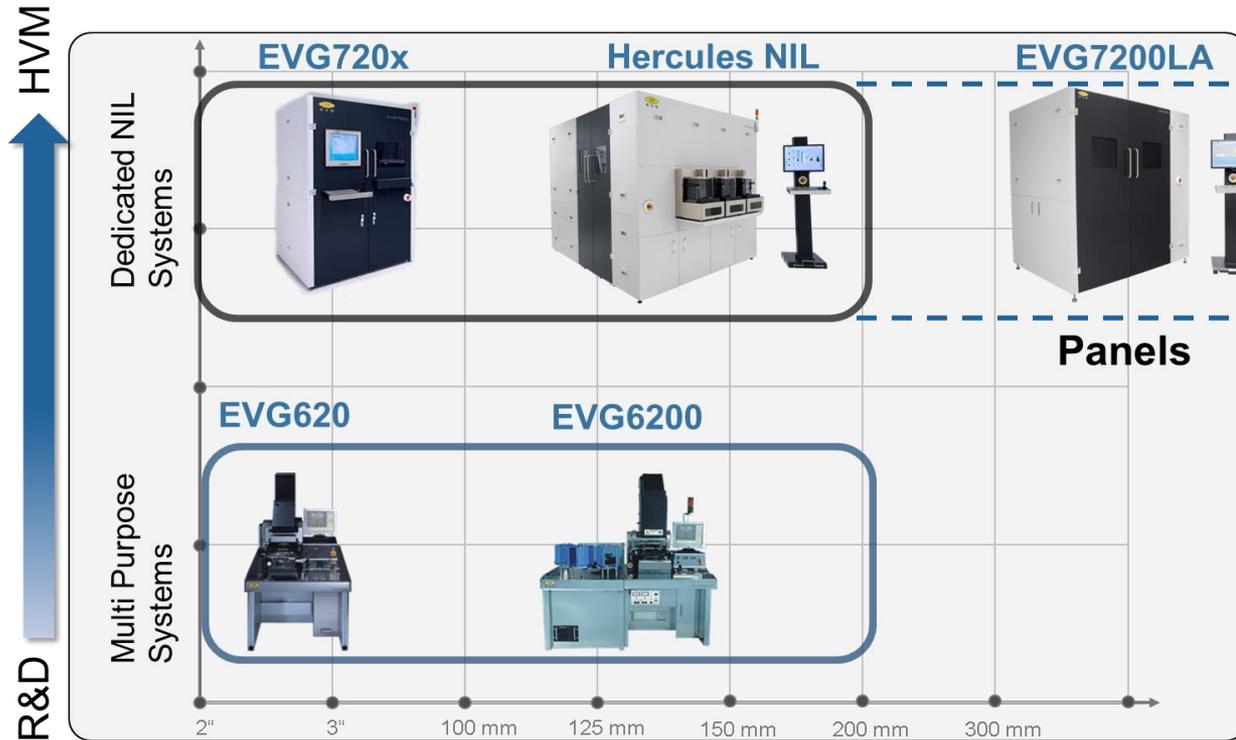
- Enables highest resolution at low cost
- Not diffraction or depth-of focus limited
- No optical proximity effects

## Direct Patterning



- Imprint materials can be functionalized to needed properties
- Reduces process steps significantly

# EVG SmartNIL<sup>®</sup> Product Family

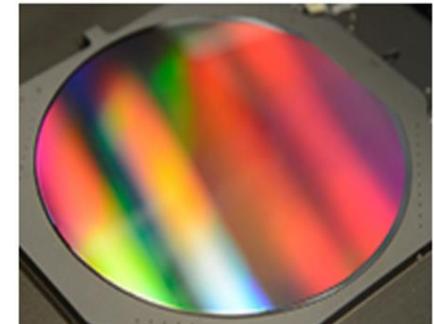


## SmartNIL<sup>®</sup> - Equipment:

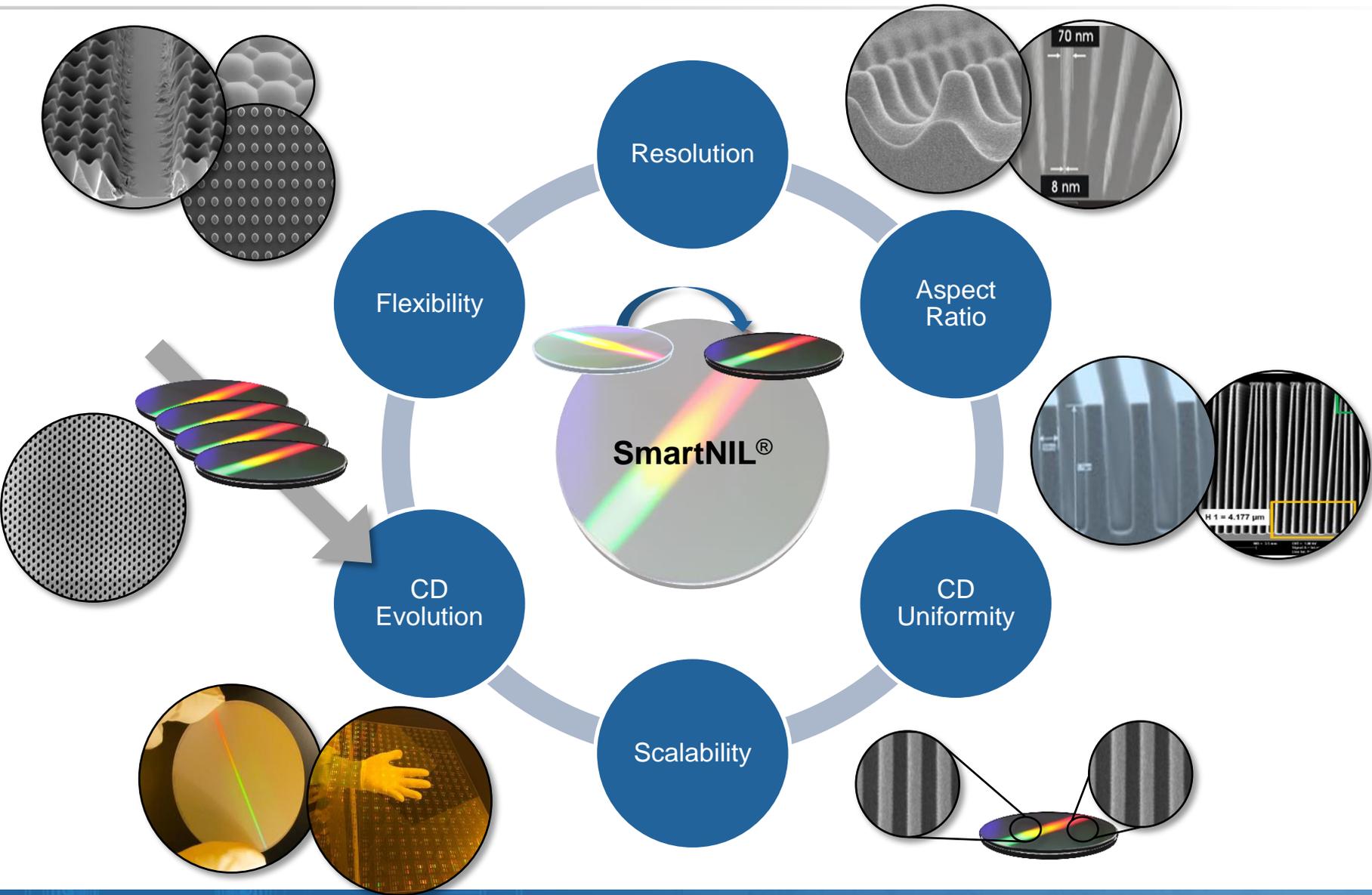
- R&D multi-purpose systems
- Automated stand-alone systems
- Integrated systems
- Panel-size systems

## SmartNIL<sup>®</sup> - Features:

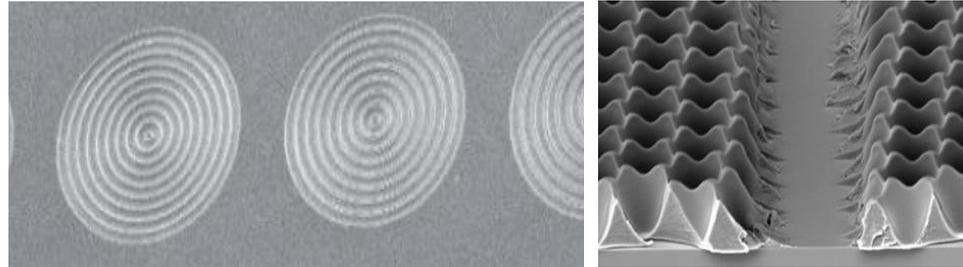
- Room-Temperature Process | UV-Curable Resist
- Wafer Size up to 8\" | Gen2 Panel Size
- Robust and Field-Proven Proprietary SmartNIL<sup>®</sup> Technology
- Flexible Soft Stamp | Simple & Fast Stamp Fabrication Process
- Permanent Functional Layers Achievable
- High Fidelity Replication | High Dimensional Uniformity



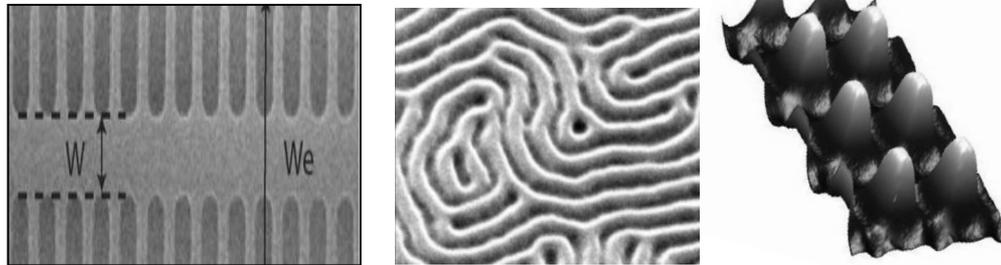
# SmartNIL<sup>®</sup> Capabilities



**Diffractive Optical Elements**

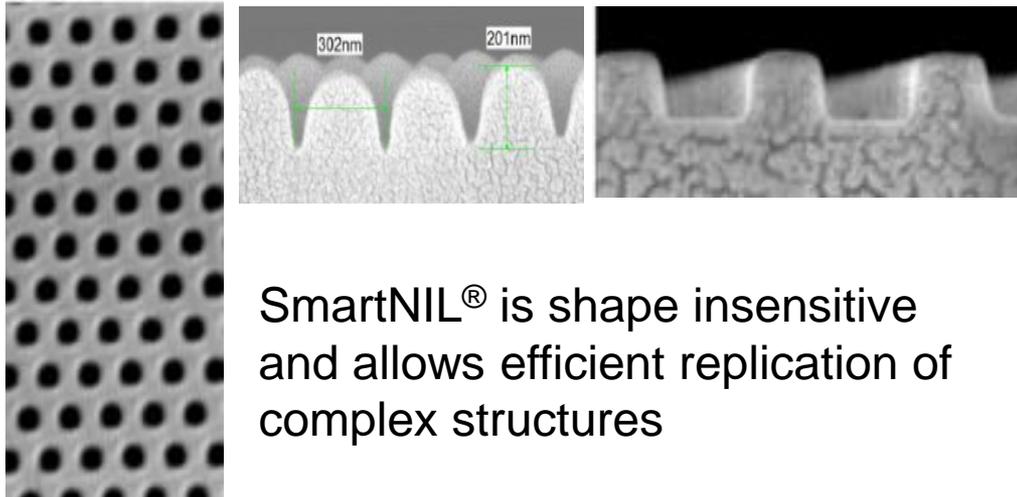


**Holographic Structures**



**Optical Gratings**

**Anti Reflective Structures**



**Plasmonic Structures**

SmartNIL<sup>®</sup> is shape insensitive and allows efficient replication of complex structures

Arbitrary 3D Structure

# Optical Sensing

## INERTIAL

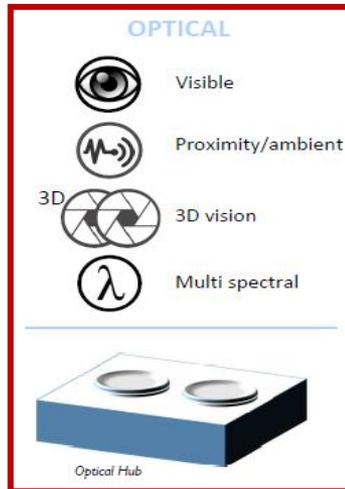
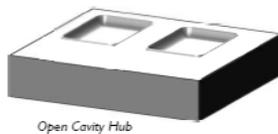
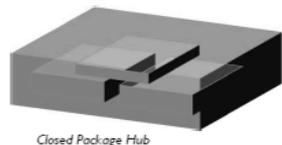
-  Accelerometer
-  Gyroscope
-  Magnetometer
-  6 DOF IMU

## ENVIRONMENTAL

-  Gas/Particle
-  Pressure
-  Temp/Humidity
-  Microphone

## OPTICAL

-  Visible
-  Proximity/ambient
-  3D vision
-  Multi spectral



More than Moore devices require novel patterning methods to achieve economy of scale

Source: Yole

Wafer level processing enables:

- Smallest form factors,
- High performance
- Cost efficient manufacturing

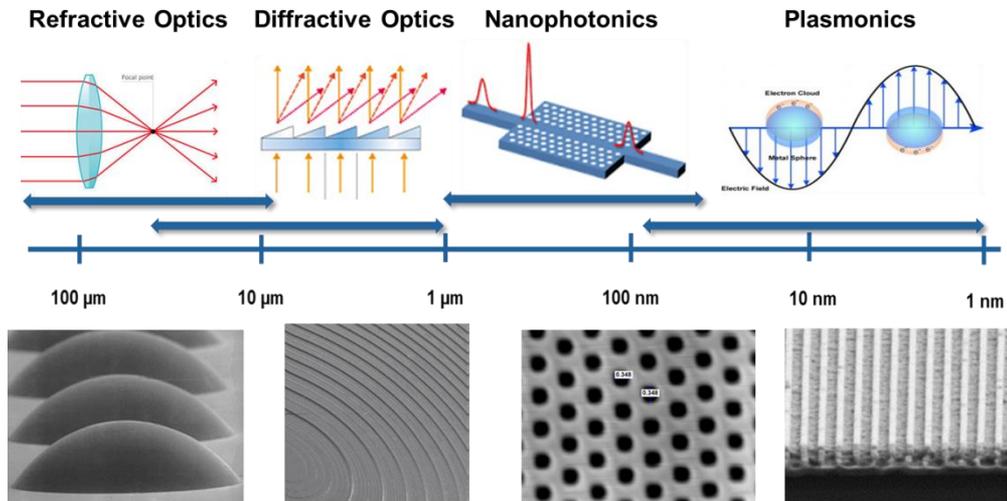


Source: Heptagon

# NIL Applications

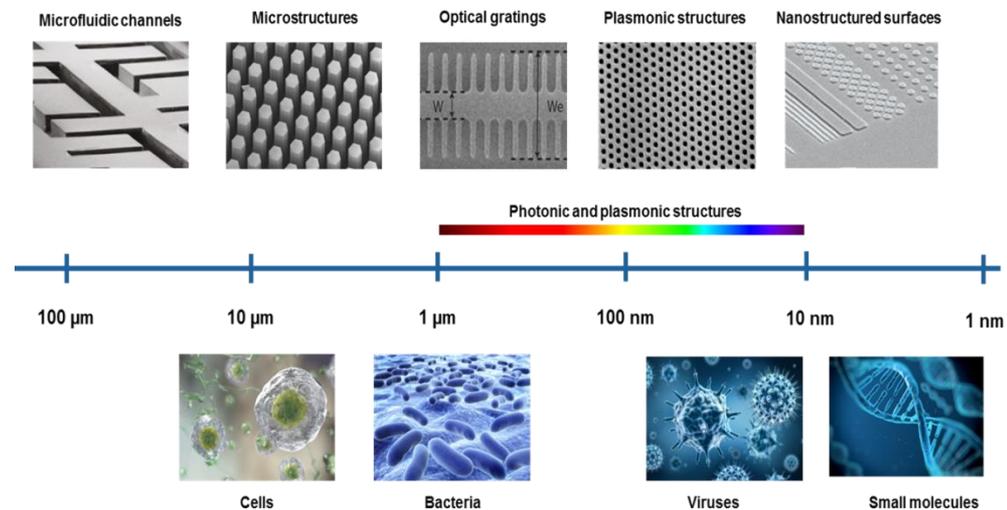
## Photonics

- Imaging and 3D Sensing
- Spectral Imaging and Gas Sensing
- Biometrics and Gesture Recognition
- Beam shaping and Filters
- Photonic Integration
- Plasmonics



## Bio and Medical Technology

- Chemical Sensors & Biosensors
- Lab-on-a-Chip
- Organ-on-a-Chip
- DNA, RNA & Protein Chips
- Drug Delivery



# Increase of SmartNIL<sup>®</sup> Capabilities



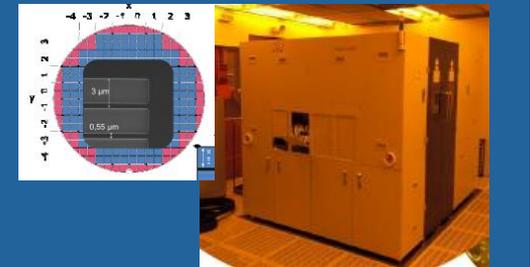
Equipment, Automation & System Integration  
 Scaling for alternative substrates sizes  
 Optimized Customer Solutions



Imprint process optimization  
 Imprint tooling optimization  
 Process performance & stability



Process Integration with CMOS standards  
 Advanced Metrology and Inspection  
 Application specific process solutions

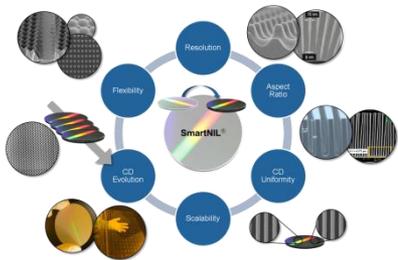


# Key Takeaways

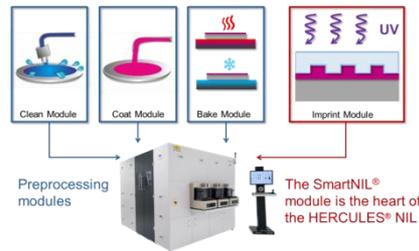
## Wafer-level Nanoimprint Lithography

SmartNIL<sup>®</sup> is established for photonic, bio and backend-like manufacturing

### Proven capabilities



### Equipment Readiness



### Addressing Challenges Beyond



### Targets

Enabling novel devices and applications

Fully CMOS compatible production line

### Goals

Imprint Technology Improvement

Platform Improvements

Process Integration

### Addressed Topics

Overlay, Yield, Material Influence

Automation, Process Monitoring, Performance

Etching, Deposition, Mix and match Lithography



# Thank You!

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