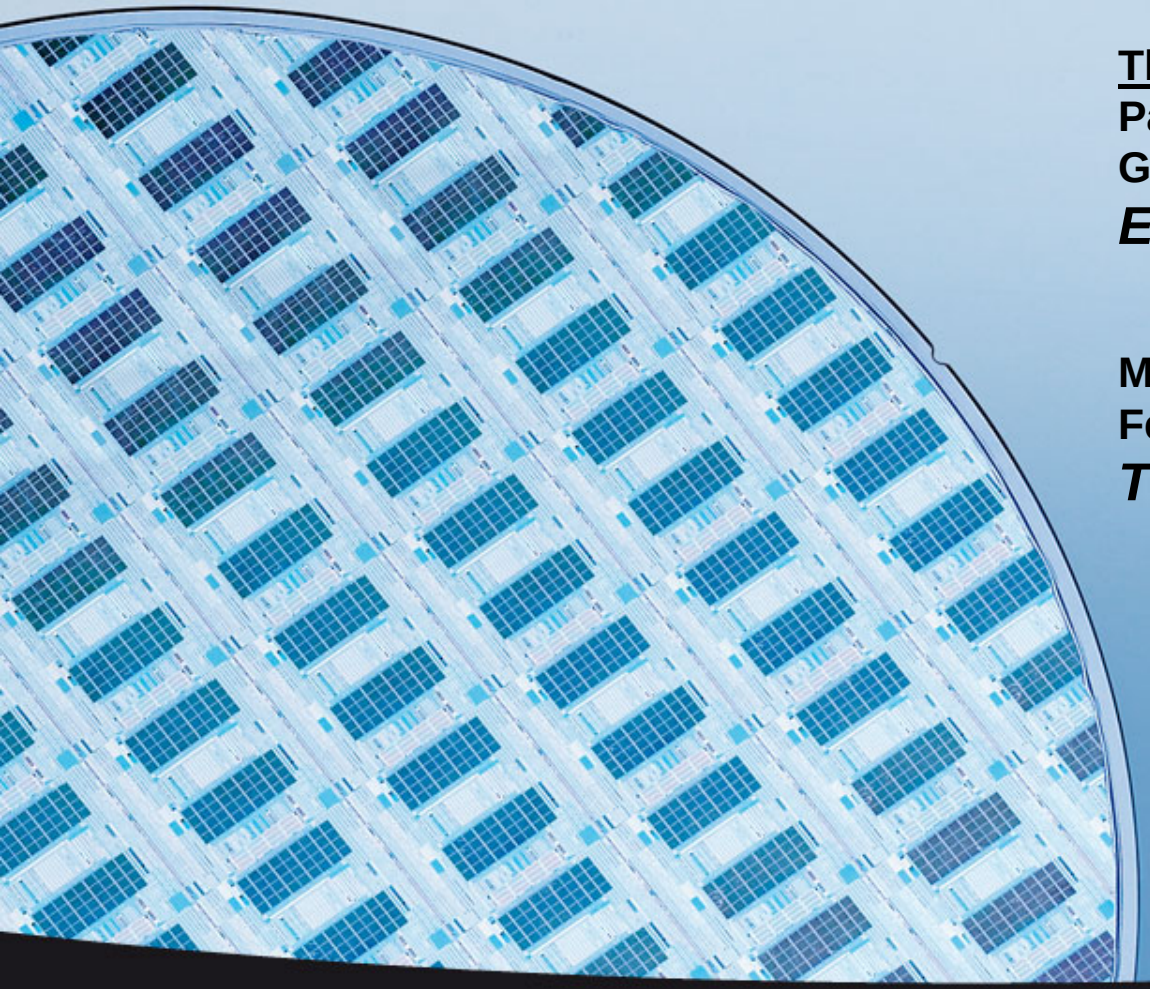
EV Group

300mm Wafer-level image sensor packaging



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EV Group

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Tessera Technologies Inc

300mm Wafer-level image sensor packaging

Outline

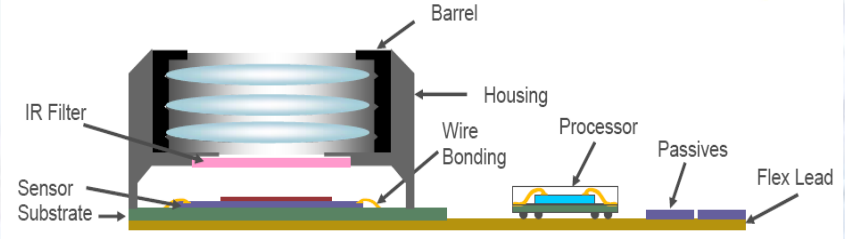
- **Wafer level cameras**
- Wafer level packaging (WLP)
- Wafer level optics (WLO)

Source: Tessera

Wafer Level Camera (WLC)

Conventional Camera Module

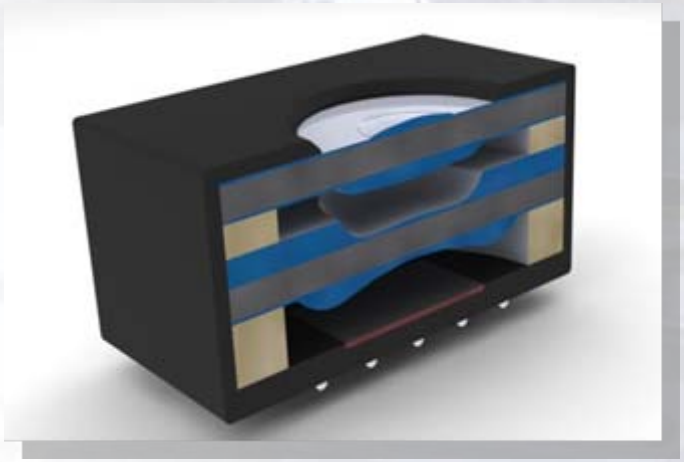
- Discrete assembly
- Focal planes to be adjusted manually
- Comparatively large form factor
- Decreasing profit margins



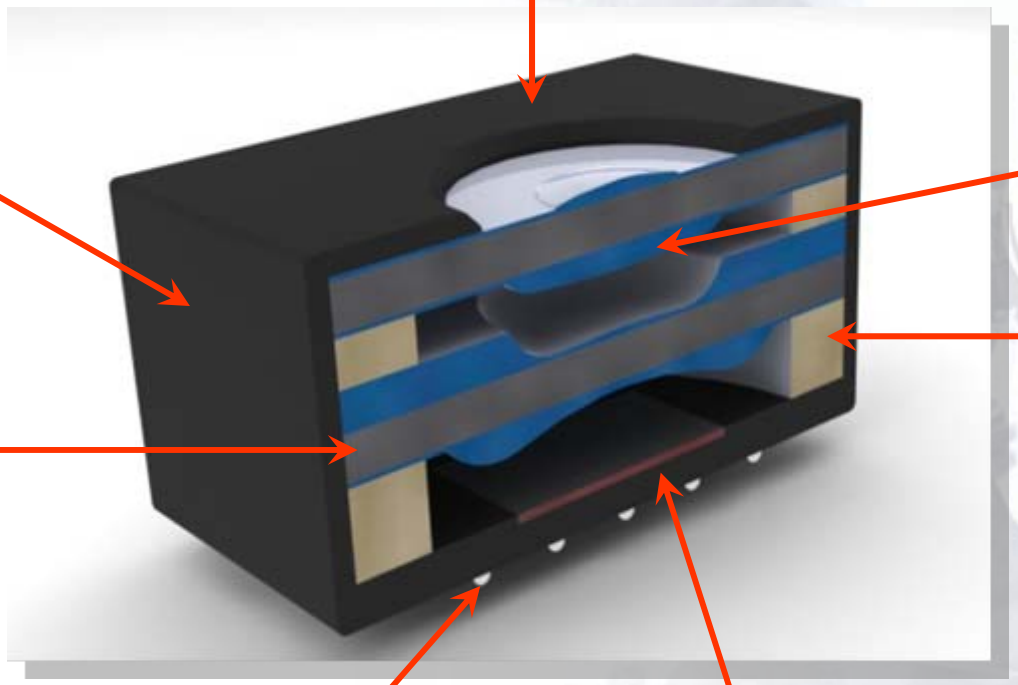
Source: Tessera

Wafer Level Camera Module

- Fully integrated device
- Highly accurate assembly
- Small form factor
- Lower cost per module
- Better image quality

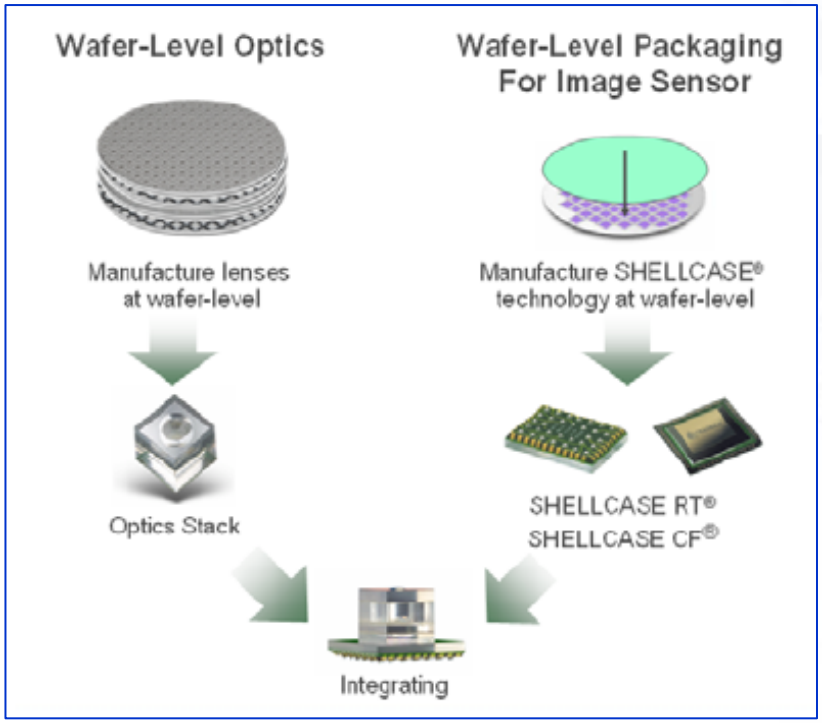


Wafer Level Camera – Close-up



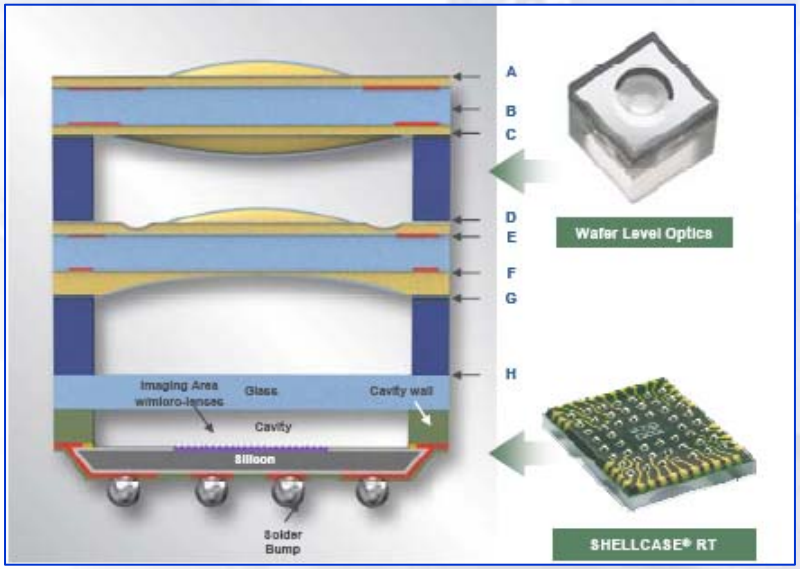
Wafer level camera manufacturing

I) Manufacturing flow



Source: Tessera

II) Cross section



Source: Tessera

300mm Wafer-level image sensor packaging

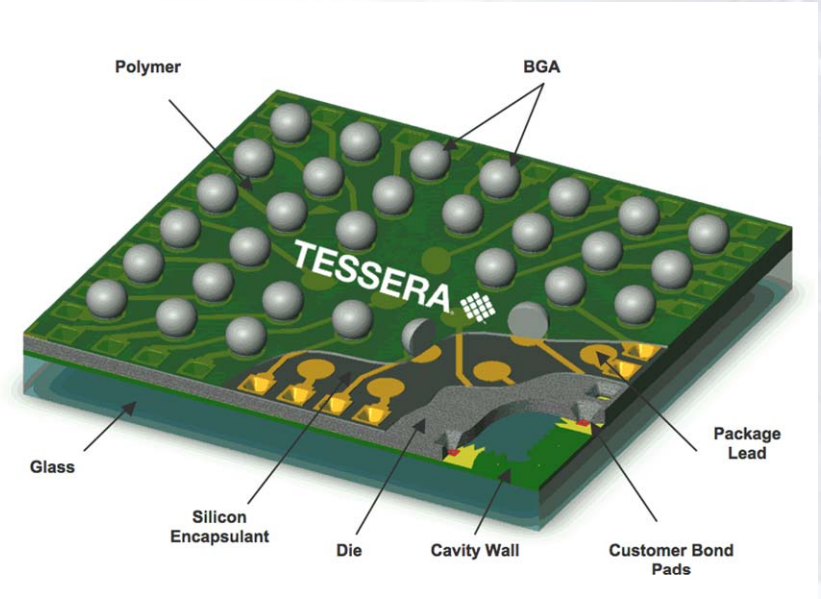
Outline

- Wafer level cameras
- **Wafer level packaging (WLP)**
- Wafer level optics (WLO)

Process flow for Tessera's OptiML™ Micro Via Pad WLCSP

5 major steps

- Sensor wafer is encapsulated with a cover glass (wafer bonding)
- Formation of through silicon vias (TSV)
- Fill the vias and route electrical contacts
- Formation of solder bumps (BGA)
- Singulation of packaged sensor wafer into individual packaged sensor dies

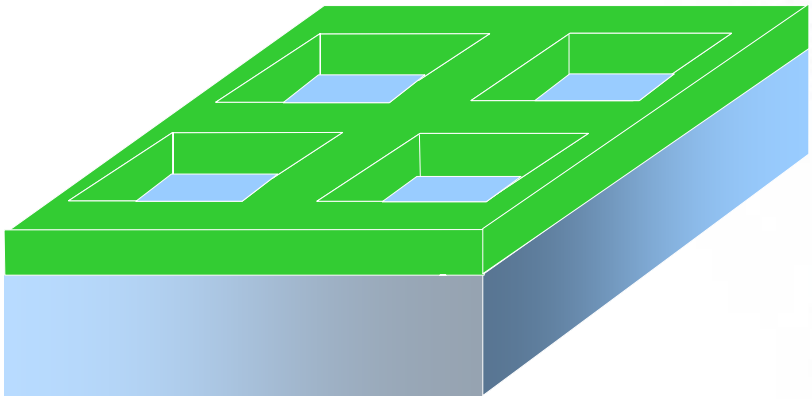


Source: Tessera

Cavity formation

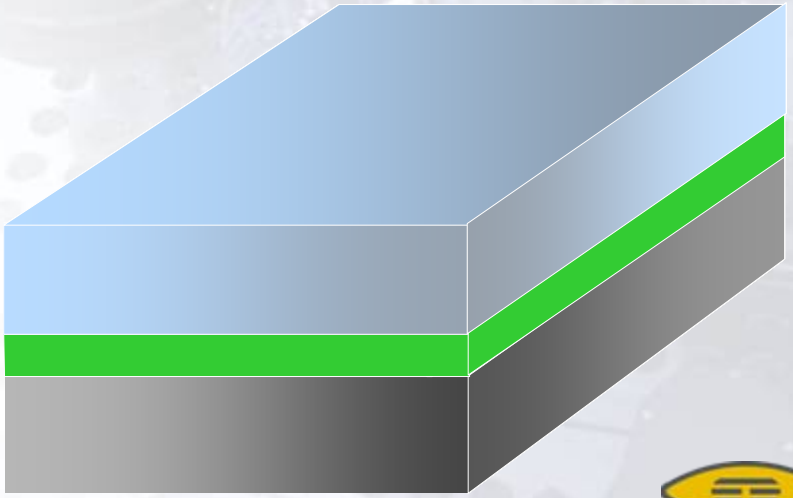
I) Sidewall formation

- Photo-imageable polymer side walls
- Thick resist lithography
  - Thickness: 10-50 µm
  - Edge bead prevention
  - Large gap mask alignment
  - Alignment accuracy: <1 µm (3σ)



II) Cavity capping

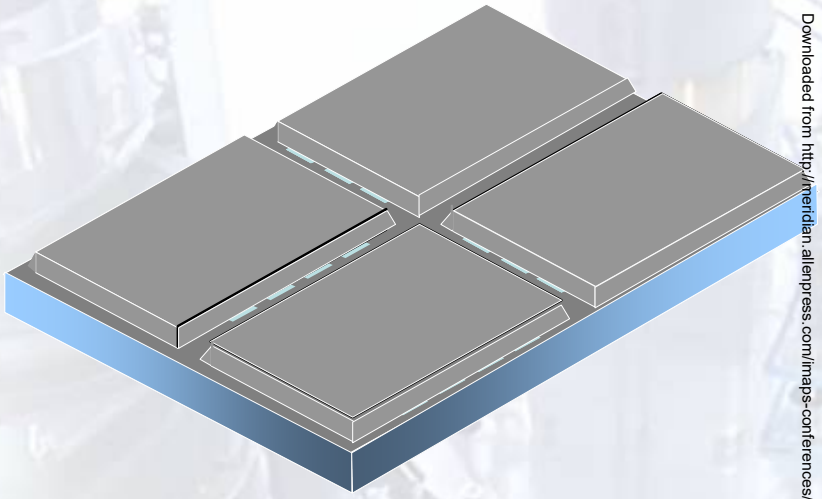
- Wafer bonding
- Recipe adjusted for CTE mismatch (glass vs. Si)
- Pressure and temperature uniformity <2%
- Fast cycle time
  - Heating ramp: 45°C



Wafer thinning and trench formation

Wafer thinning

- Image sensor wafer thickness: 70-200 µm
- Glass cover wafer acts as handle wafer.

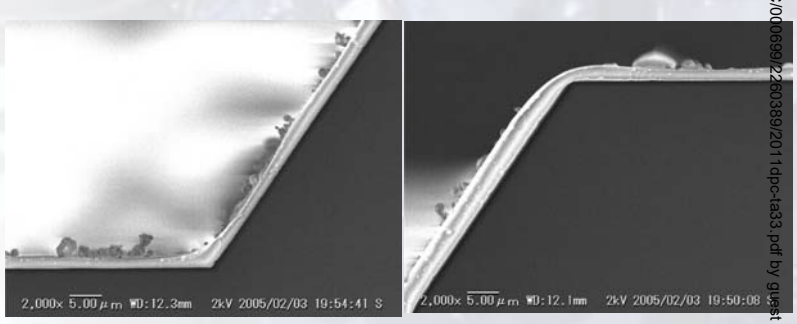


Trench formation

- Front-to-backside mask alignment: <2 µm (3σ)

Conformal coat for TSV formation

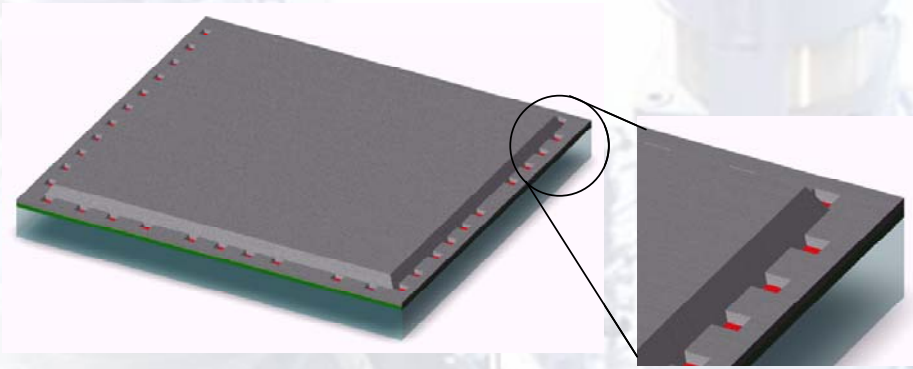
- Spray coating
- **OmniSpray® process**



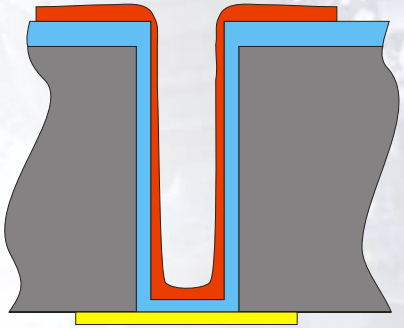
Spray coating enables conformal coatings of wet- and dry-etched structures.

TSV formation

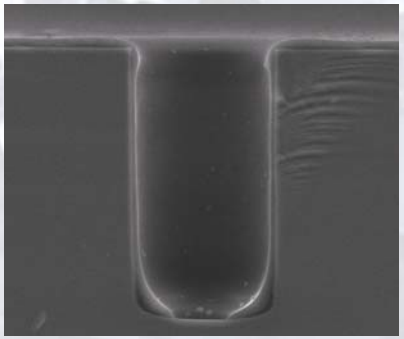
- TSVs at the bottom of the trenches
- Front-to-backside mask alignment
- TSV etching



- Passivation layer – conformal TSV coating
  - **NanoSpray™ process**
  - Qualified materials
    - Positive tone resists
    - Negative tone resists
    - Dielectric materials



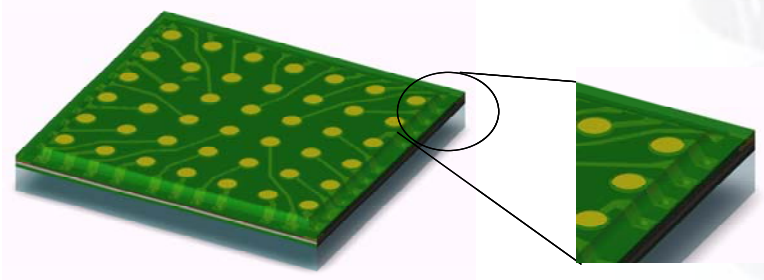
NanoSpray™ coating



100 µm × 200 µm (after lithography)

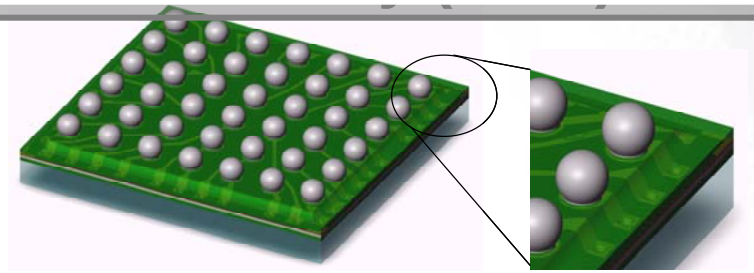
Electrical contact routing, BGA and singulation

Electrical contact routing



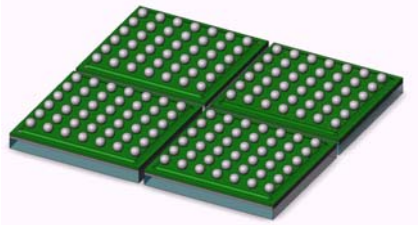
EVG150 Coat / Develop

Ball Grid Array (BGA)



EVG IQ Aligner

Singulation



300mm Wafer-level image sensor packaging

Outline

- Wafer level cameras
- Wafer level packaging (WLP)
- **Wafer level optics (WLO)**

EVG's Wafer Level Optics Fabrication Technologies

Step and Repeat (S&R) UV Imprint Lithography

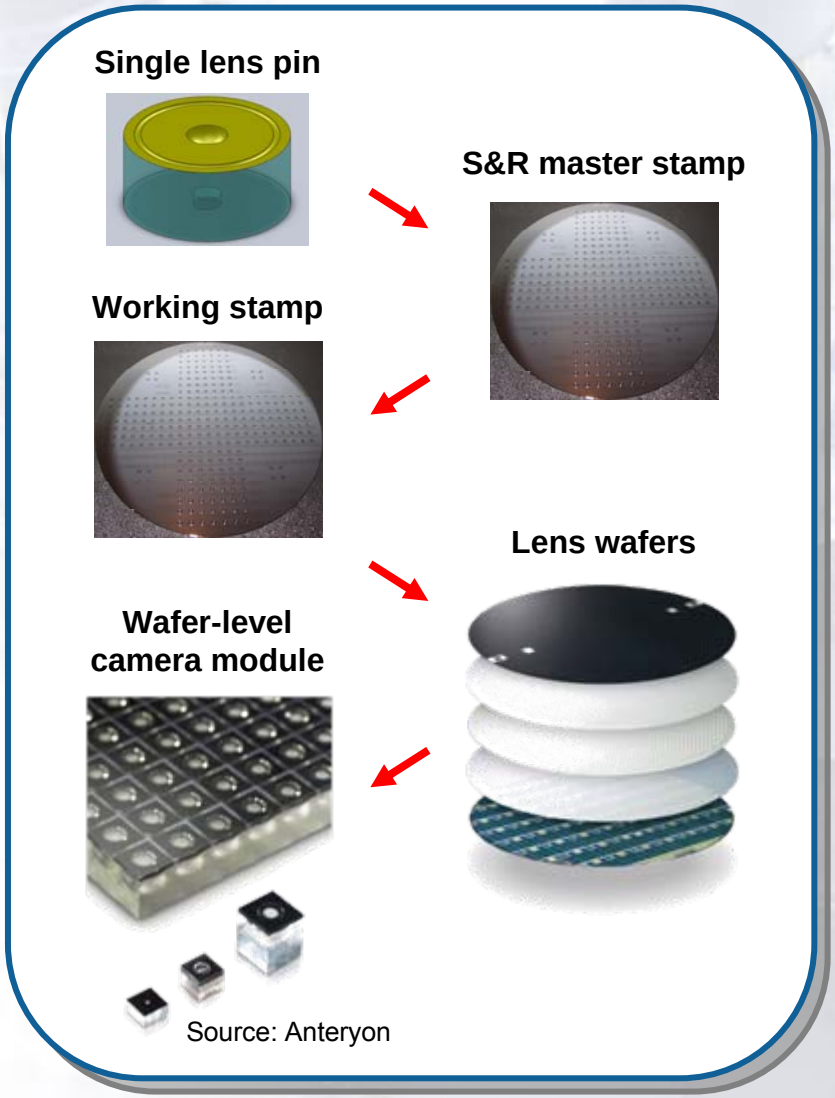
- S&R master stamp fabrication

Wafer-level UV Imprint Lithography

- Working stamp fabrication
- Hybrid lens molding
- Monolithic lens molding

Aligned UV Wafer Bonding

- Spacer bonding
- Lens wafer stacking
- Smart lens fabrication

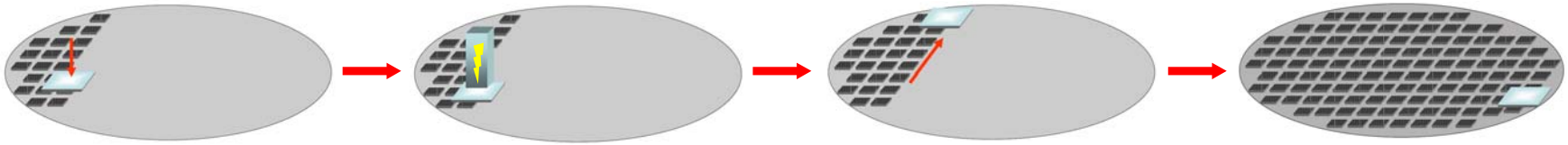


Step and Repeat Master Stamp Fabrication

EVG®770 NIL Stepper

- Semi-automated step and repeat process for high throughput master stamp fabrication
- Gap or Force controlled imprint
- High precision alignment system <100nm
- Vacuum environment for superior pattern fidelity
- Wafer sizes from 100mm up to 300mm

Step and Repeat Master Stamp Fabrication on EVG®770 NIL Stepper



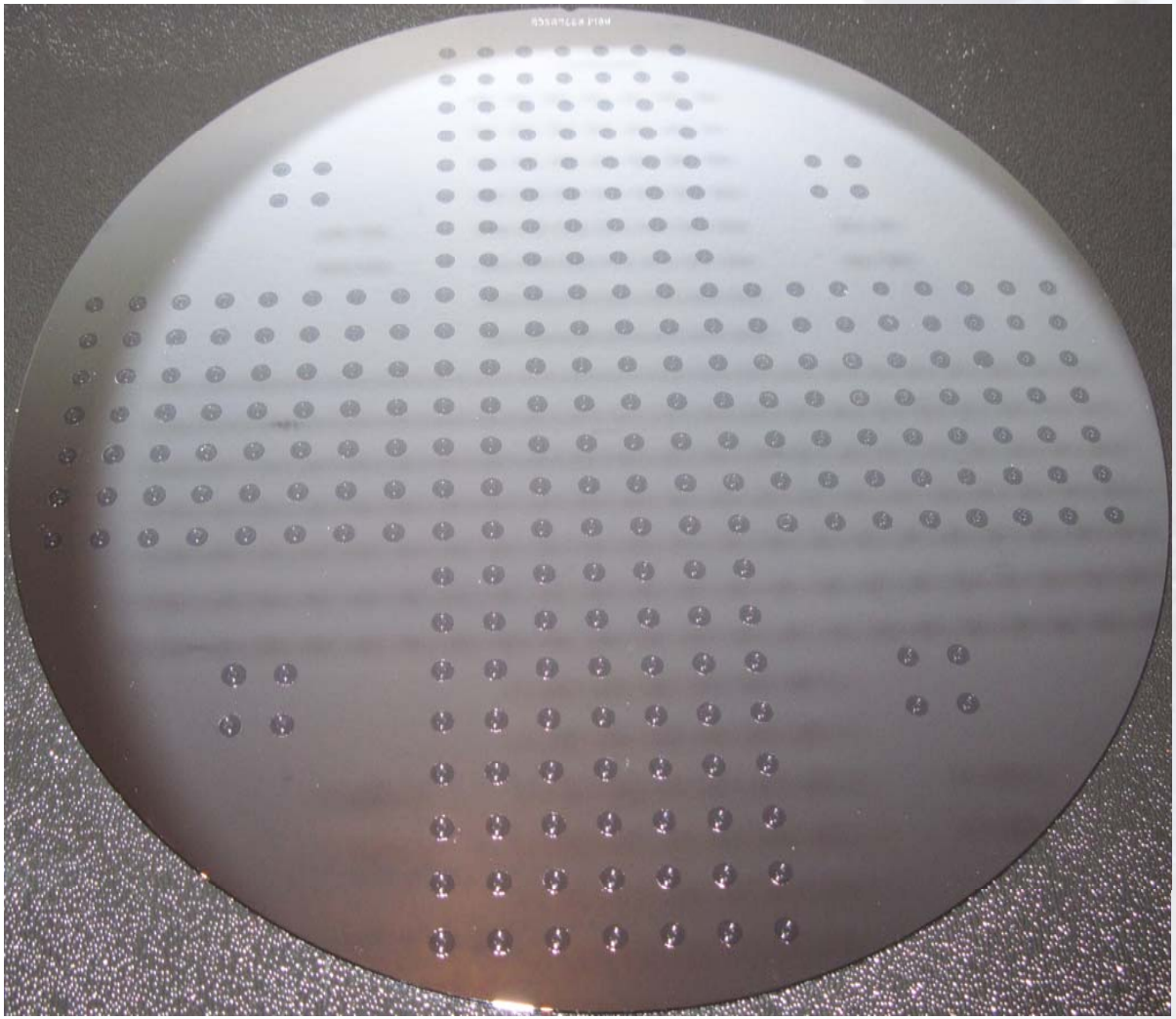
Imprint die on wafer

Cure imprint polymer and de-emboss template

Move to next die and imprint again

Imprint complete wafer according to die layout

Step and Repeat Master Stamp



200 mm S&R Master Stamp

Only one single lens has to be manufactured instead of full area master machining

lower CoO

Superior placement accuracy (< 100 nm x and y direction)

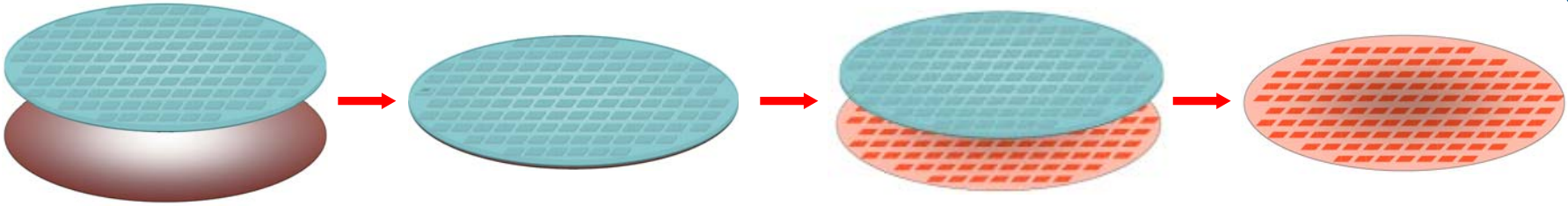
Performance

Superior lens to lens pattern fidelity

Performance

Hybrid WLO/Puddle Dispens - Process Flow

Single/double side microlens molding on IQ Aligner – puddle dispense



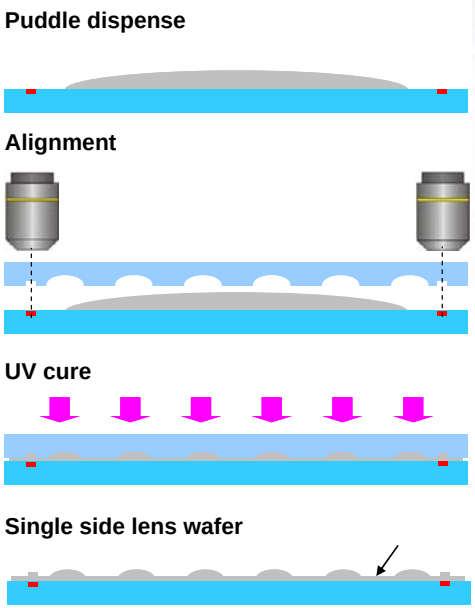
Dispense optical polymer onto substrate wafer

Contact wafer and working stamp and cure imprint polymer

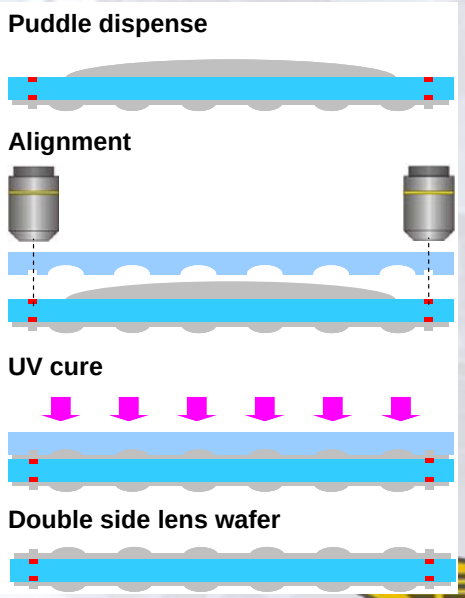
Automatic de-molding of working stamp and wafer

Unload single shot full field imprinted wafer

Single side molding



Double side molding



Summary

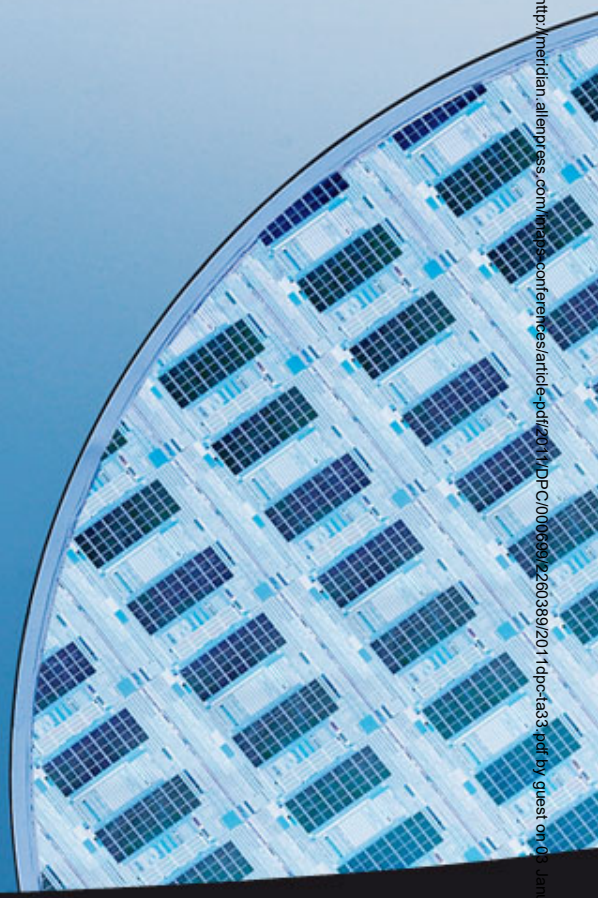
- Parallel manufacturing paths for
  - Wafer level packaging (WLP)
  - Wafer level optics (WLO)
- Wafer level packaging for image sensors
  - Wafer bonding for cover glass
  - TSVs enable small form factor
- Wafer level optics for image sensors
  - UV replication process for mirolenses
  - Master fabrication from single lens pin through step-and-repeat process
  - Single side or double side imprinting

EV Group

For further discussion please visit us at booth #61.

www.EVGroup.com

Triple i - The key to your success



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