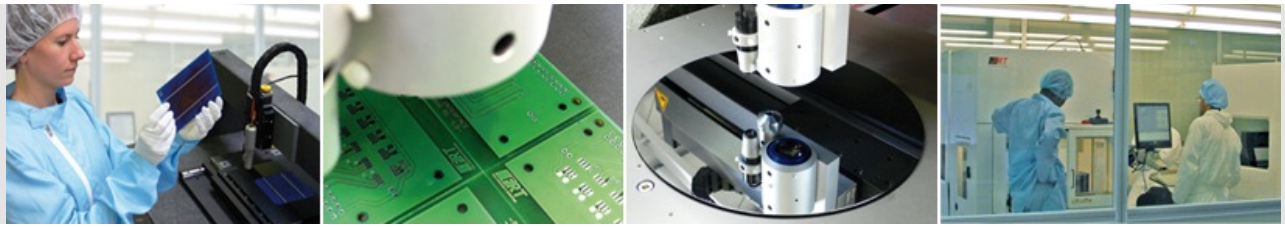


Multi Sensor 3DIC Metrology

DAETEC and FRT - Fries Research & Technology – Booth 2532

…since 1995

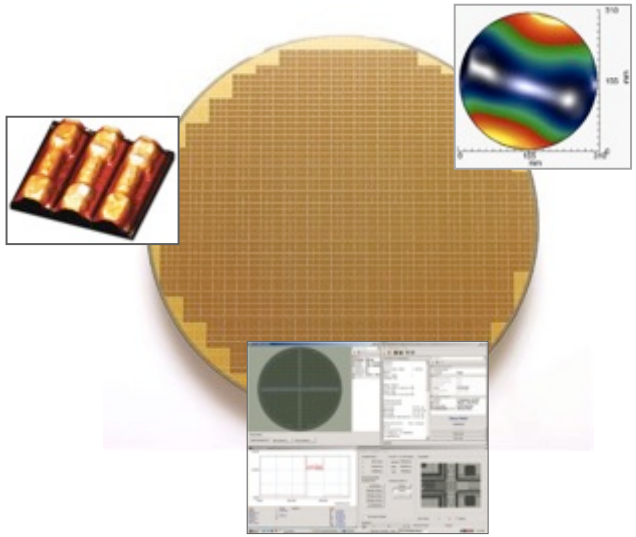
FRT MicroProf®

Wafer Metrology Tools

the art of metrology™

MicroProf® 300

Multi Sensor metrology tool with 300 mm stage and optional housing



SEMI Compliant TTV Measurement

FRT MFE - Metrology for Frontend

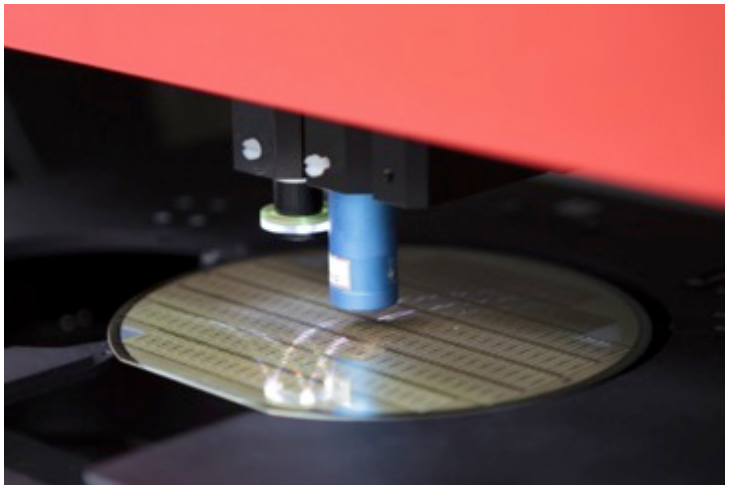
Fully automated Multi Sensor metrology tool with 300 mm stage, bridge tool, class 1 EFEM, SECS/GEM interface

MicroProf® 300 TTV MHU

Multi Sensor metrology tool with 300 mm stage, sensor setup for wafer thickness measurement (TTV), fully automated

FRT MicroProf®

Semi Automated Metrology Tools

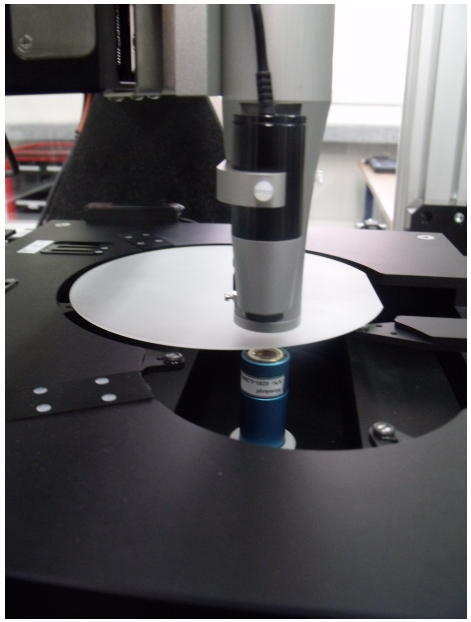


- substrates measured on the MicroProf®
- established metrology tool
- easy to use, highly reliable
- 2D profile and 3D raster scan measurements
- variable scan area selection
- chromatic white light sensors
- IR and film thickness sensors
- TSV depth measurements

FRT MicroProf® TTV

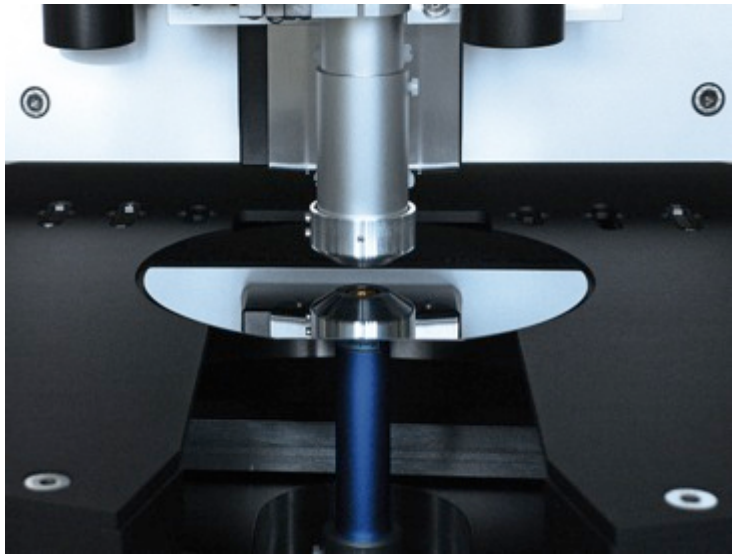
Semi And Fully Automated Wafer Metrology Tools

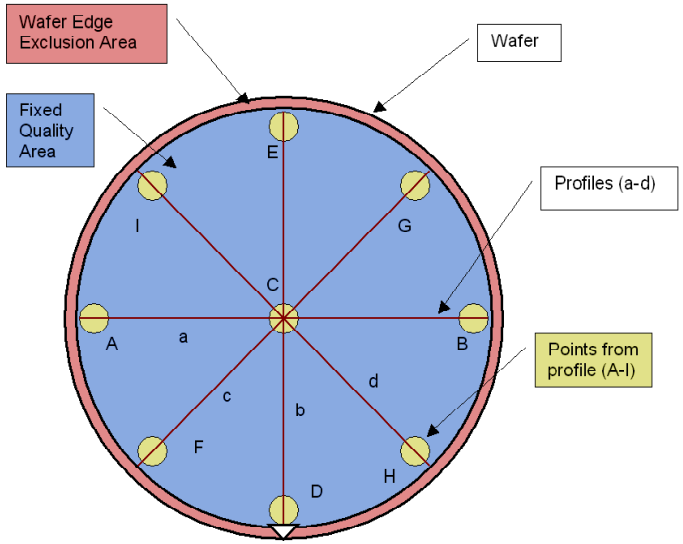
- full thickness, thinned and bonded wafers
- 2D profile and 3D mapping measurements
- additional IR and film thickness sensors
- thickness, TTV, bow and warp
- cassette to cassette
- pre-aligner
- SECS/GEM interface



FRT MicroProf® TTV

Measurements According to Semi Standards





- **fully Semi compliant**
- **sawn, ground, polished wafers**
- **material independent (Si, sapphire, glass,..)**
- **recipe driven Semi compliant software**

	MF1390	MF657	MF534	MF1530
Value	Warp	Warp, TTV	Bow	Flatness, Thickness, TTV
Methode	2-probe	2-probe	1-probe	2-probe
Flip wafer	Yes, wafer inversion method	No	Yes	No
Fixture	By mutual agreement	3-point reference plane	3-point	By mutual agreement

Overview over relevant Semi standards

FRT MicroProf® TTV

Measuring Parameters

Roughness:

- Ra
- Rmax
- Rz
- Rp
- Rt
- Rv
- Rq
- Wt

Profile:

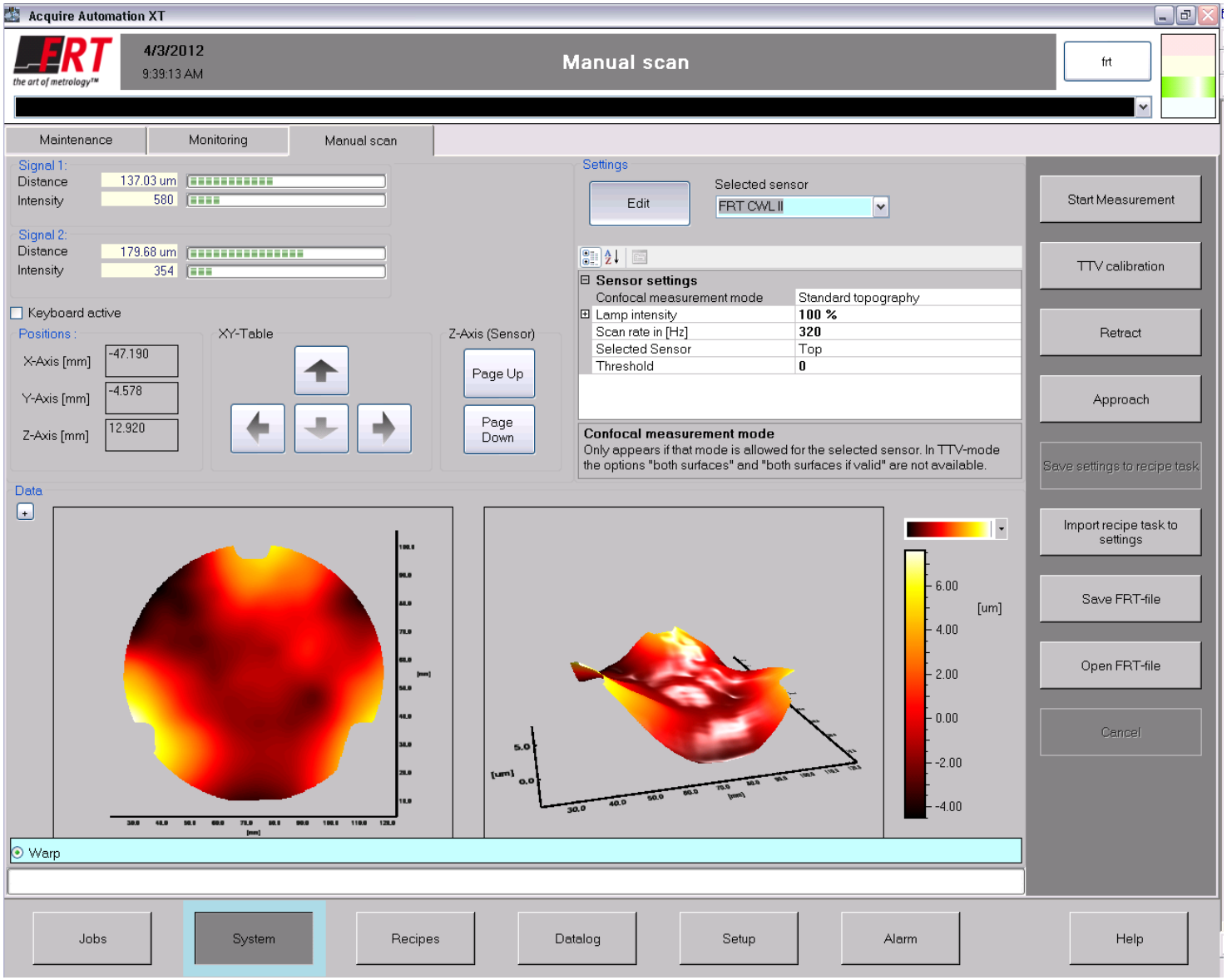
- Wafer Thickness
- Center Thickness
- Wafer TTV
- BowBF
- Wafer Warp
- Sori
- TIR
- TIR95
- Sag X
- Sag Y
- Profile Warp
- Profile Sori
- NTD
- NTV
- Profile
- Profile TTV
- TV5 / TV9
- 3D map

3D Map:

- Thickness
- Center Thickness
- Wafer TTV
- Bow BF
- Wafer Warp
- Sori
- TIR
- TIR95
- GBID
- GF3D
- GF3R
- NTV
- NTD
- Sag X
- Sag Y
- SBID
- SF3D
- SF3R
- SFLD
- SFQR
- Wafer FPD

FRT MicroProf®

Acquire Automation XT Software

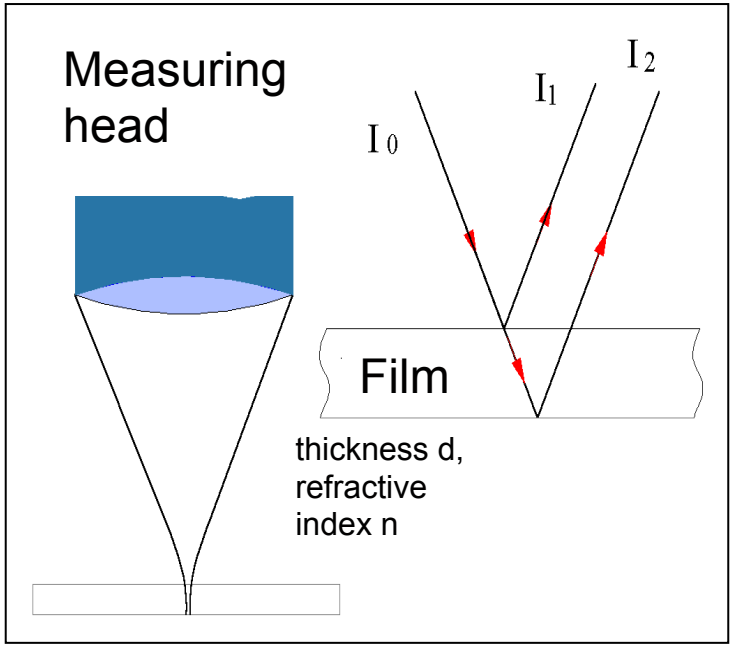


FRT MicroProf®

FRT IR Thickness Sensor Technology

- high spectral resolution
- large measurement range
- no moving parts, fast
- maintenance free

- thinned device wafer thickness
- adhesive thickness
- total thickness

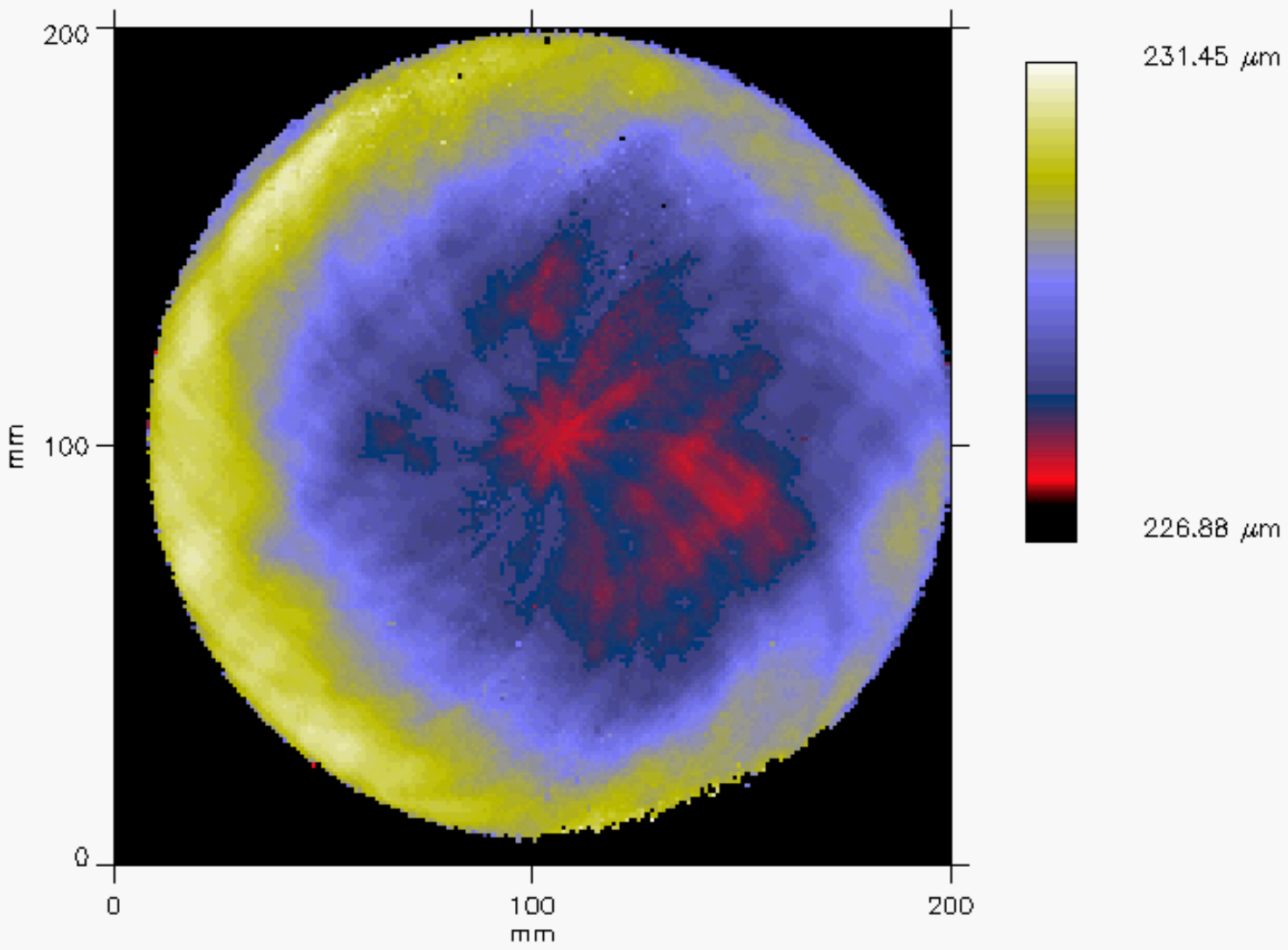


FRT CWL IR - Infrared Film Thickness Sensor

Model	IR 50	IR 250	IR 500	IR 1000
Measuring range film thickness 1)	4 – 200 µm	28 – 1100 µm	34 – 1900 µm	60 – 3500 µm
Working distance	39.7 mm			
Resolution film thickness 1)	15 nm	75 nm	130 nm	240 nm
Resolution x,y	25 µm	4.5 µm		
Numerical aperture	0.09			
Measuring angle	90° ± 5°			
Measuring rate	4,000 measurements / sec. (4 kHz)			
Light source	Halogen lamp	IR superluminescence diode		
Repeatability	< 0.0002 x measuring range			
Operating temperature	+ 5° C to + 50° C			
Dimensions (W x H x D)	260 mm x 115 mm x 310 mm			
1) At refractive index of n=1				
Scope of Delivery				
Measuring head, optical fiber, sensor electronics, operating manual				

FRT MicroProf®

IR Wafer Thickness Measurement



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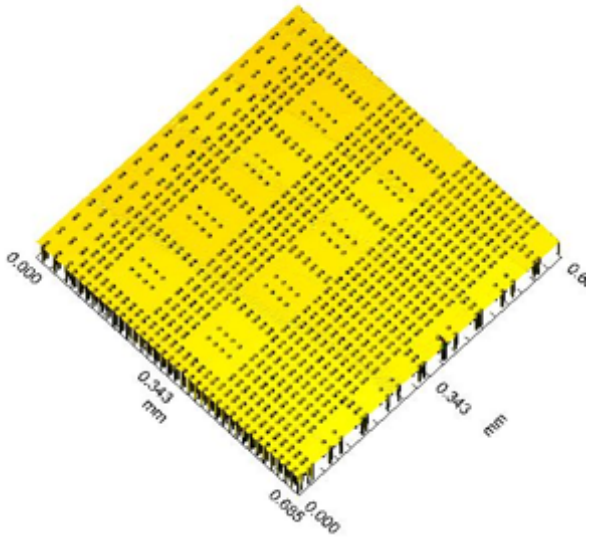
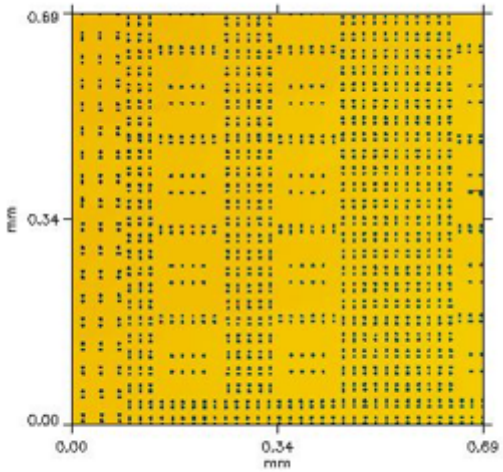
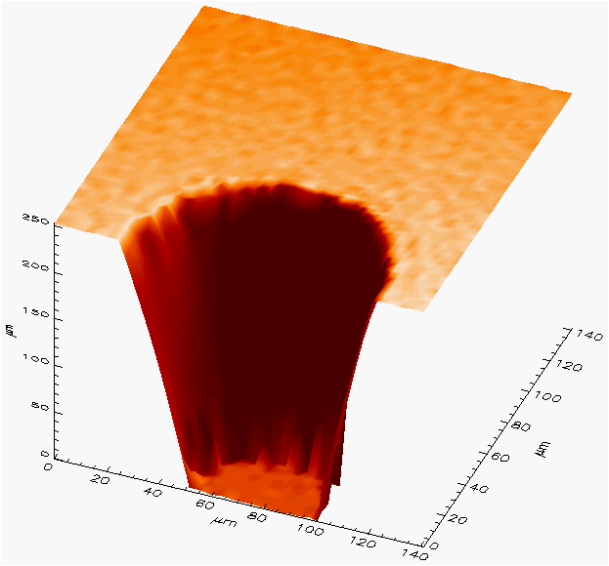
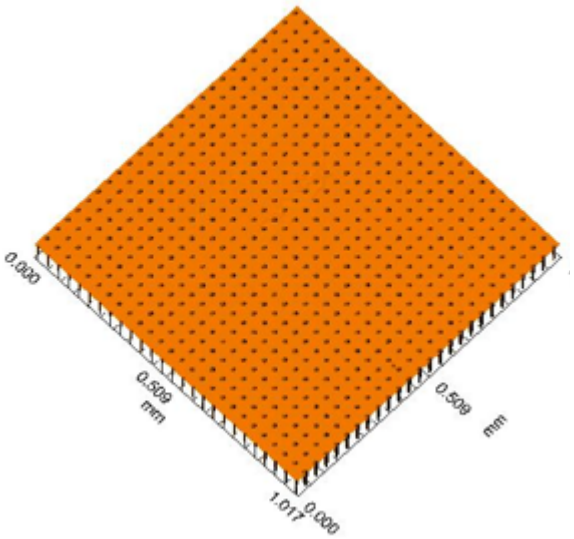
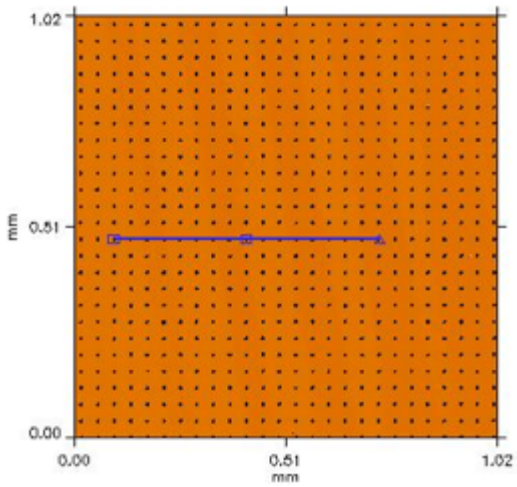
TSV Measurements

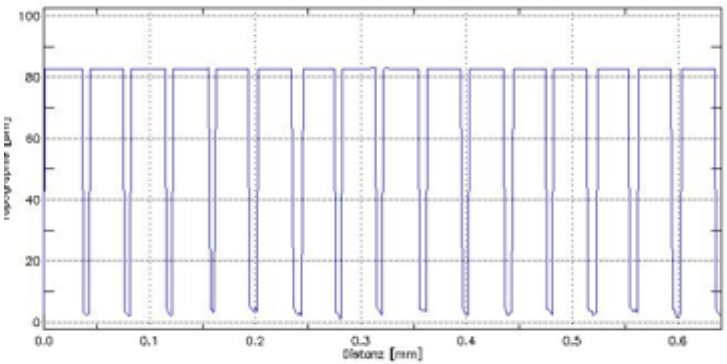






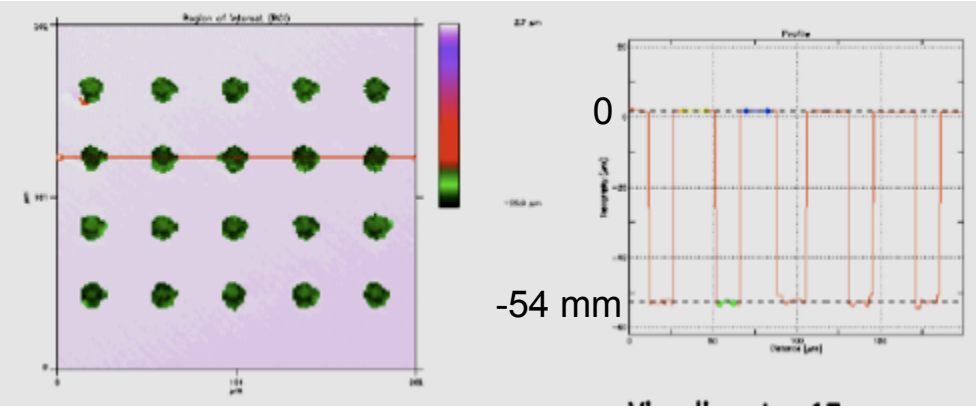




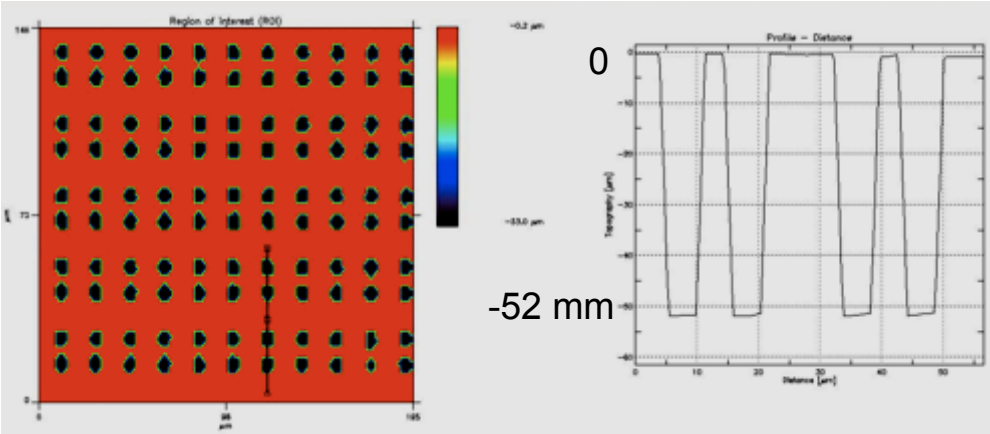


FRT MicroProf®

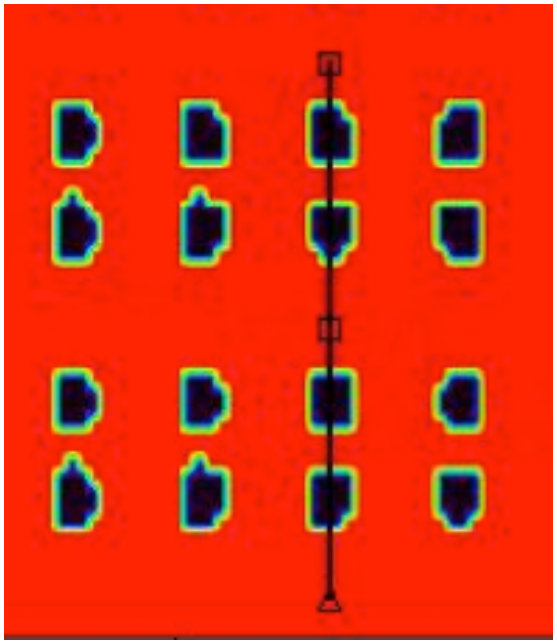
TSV Measurements



Φ = 15 mm, depth= 50 mm



Φ= 5 mm, depth= 50 mm



Pixel size=1.5 mmx1.5mm

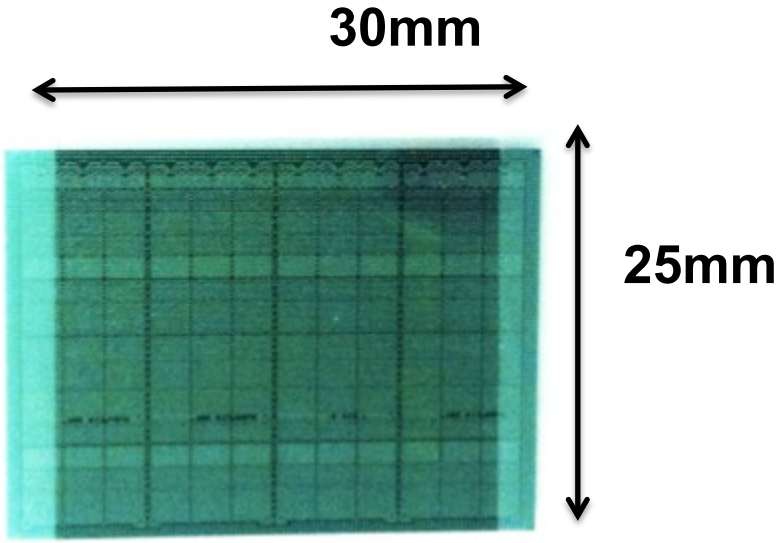
Interposer Initial Bow/Warp

- **Bow, measured by optical profilometry.**
- **Beginning bow varies from 100-120um.**
- **Convex from top point of view.**
- **Must reduce bow to <40um to allow subsequent chip bond operations**

Baseline Interposer Review

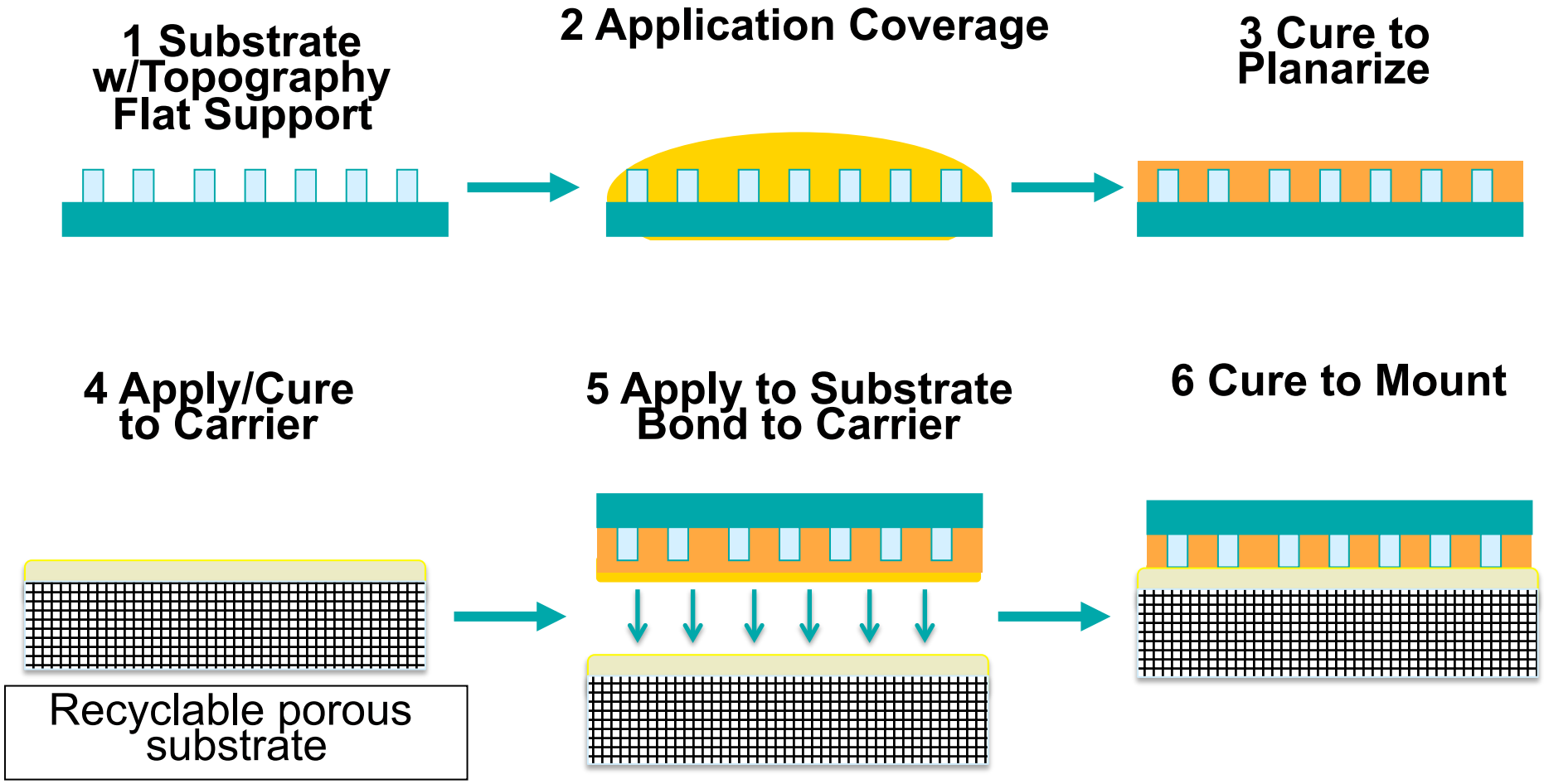
- **Substrate ~100um thickness**
- **Underlying bumps ~100um height**

Top side



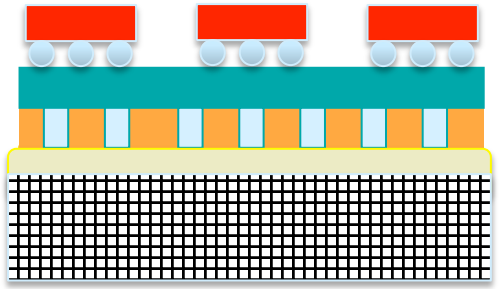
Bottom side (contains solder bumps)

Process (Coating)



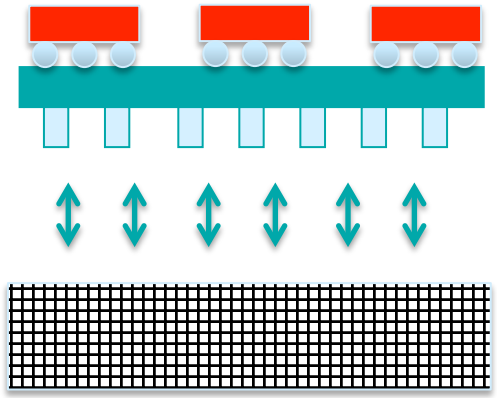
Post-Bonding Process

7 Customer Process



Bonded interposer, attach chips to interposer, Reflow 250-300C

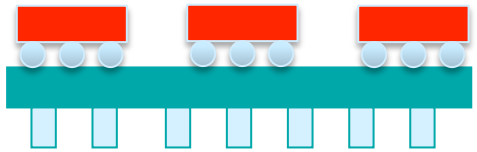
8 Debond & Cleans



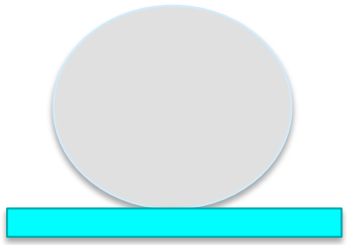
Debond and Cleans rinse, dry

Recycle carrier

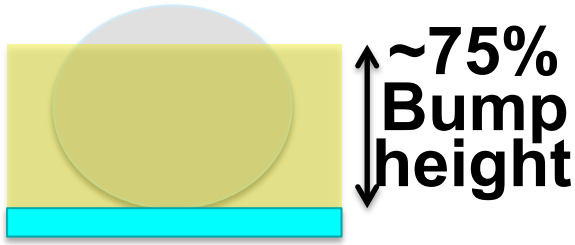
9 Acquire Final Product



Adhesive Planarization

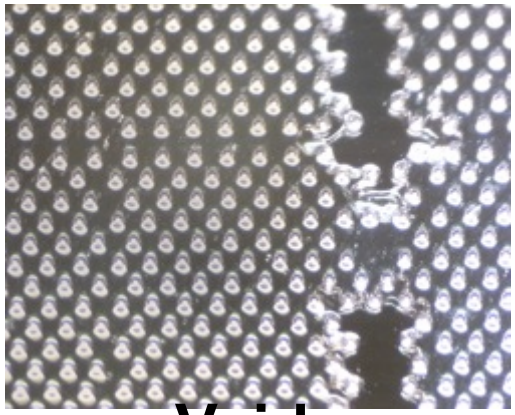


No adhesive

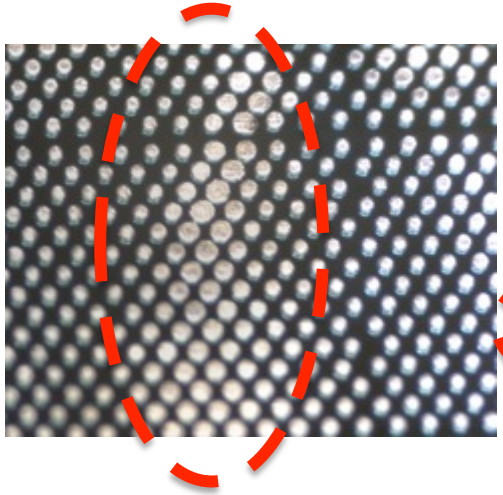


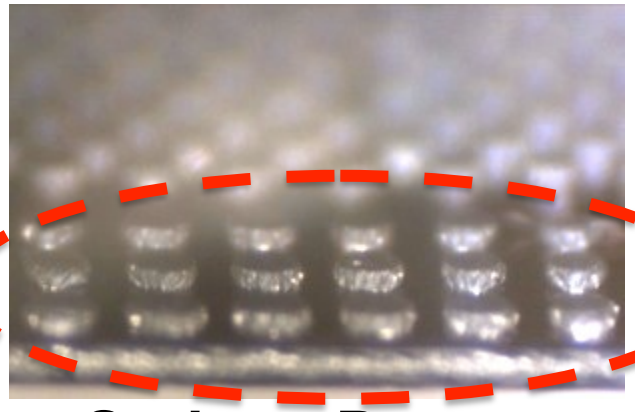
Adhesive

Planarization and Thermal Reflow

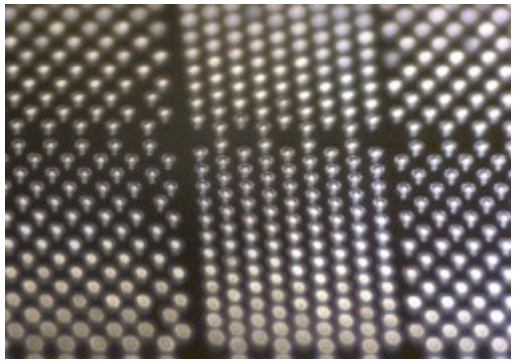


- Voids -

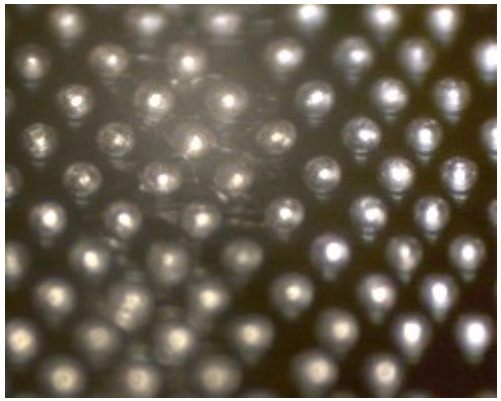


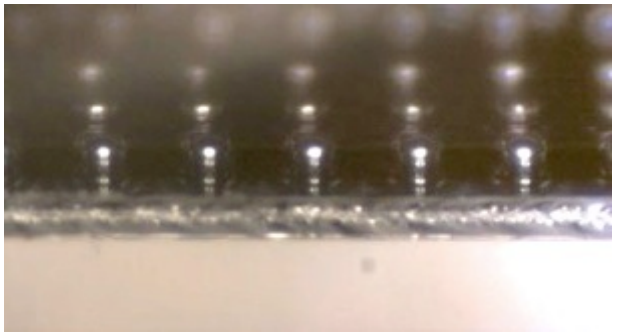


Serious Damage



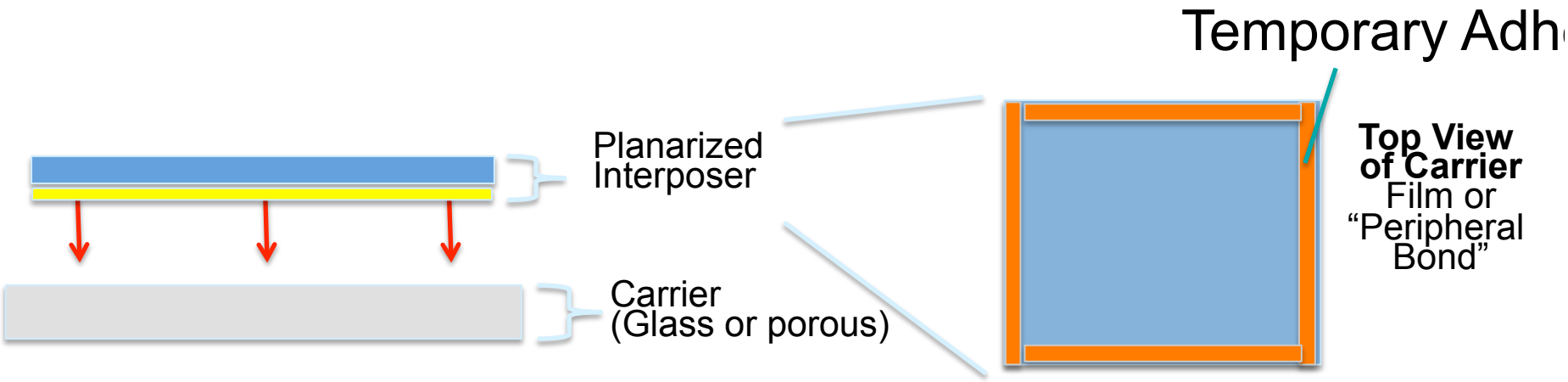
No Voids





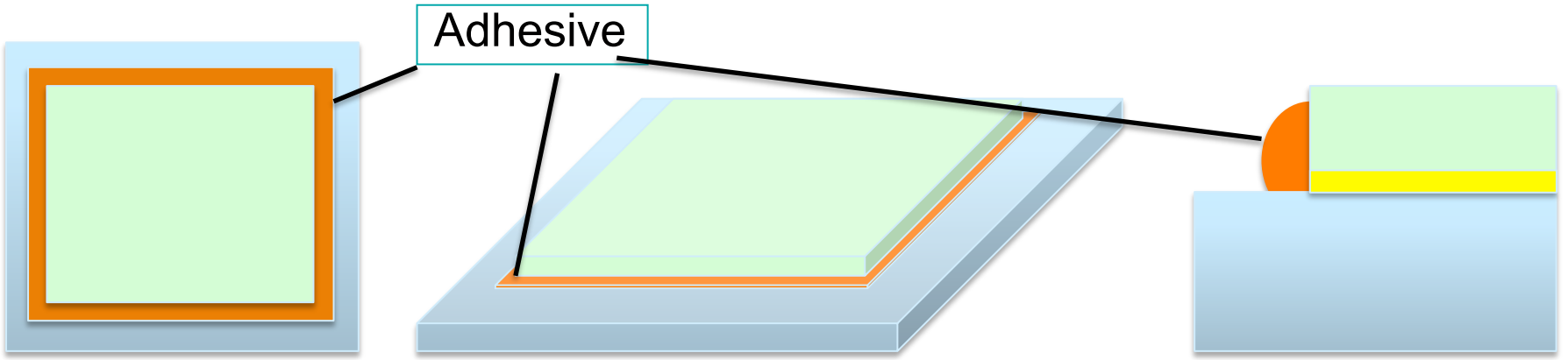
No Damage

Peripheral Bond



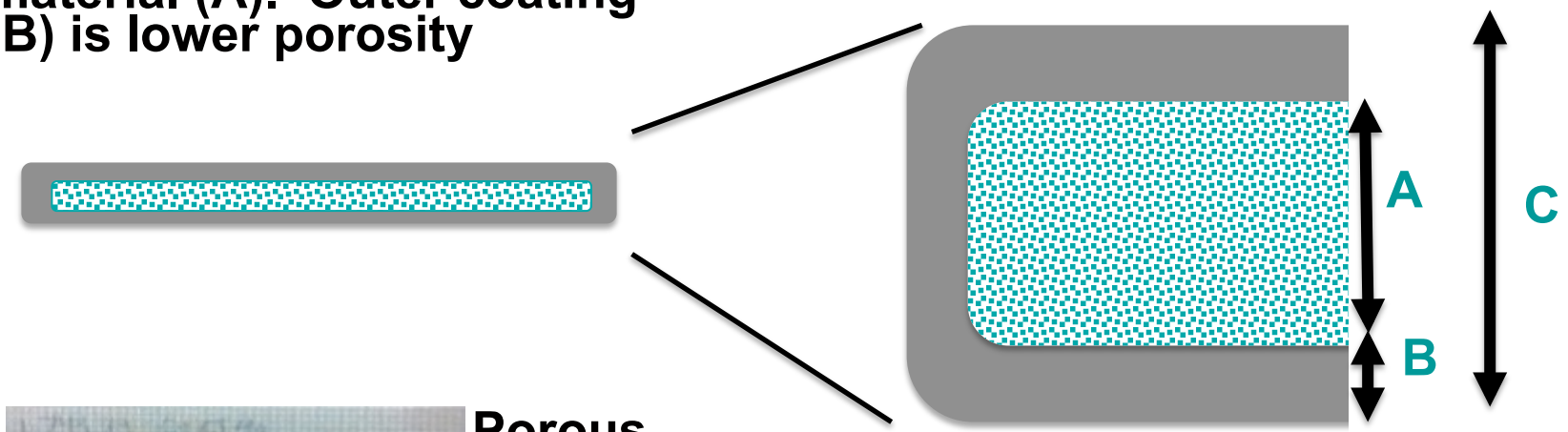
- The adhesive is applied on the edges of the carrier – known as *peripheral bond*
- Thin substrate is bonded onto carrier
- Adhesive is cured

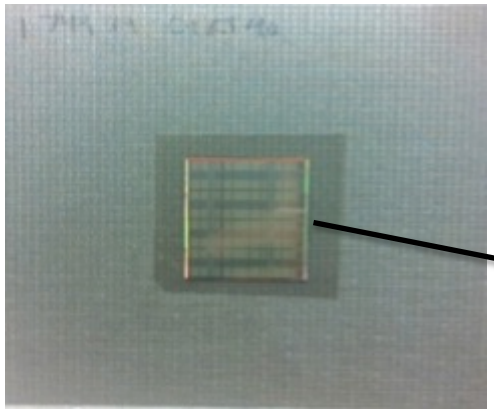
Description of Adhesive



Porous Carrier

Porosity higher for inside material (A). Outer coating (B) is lower porosity



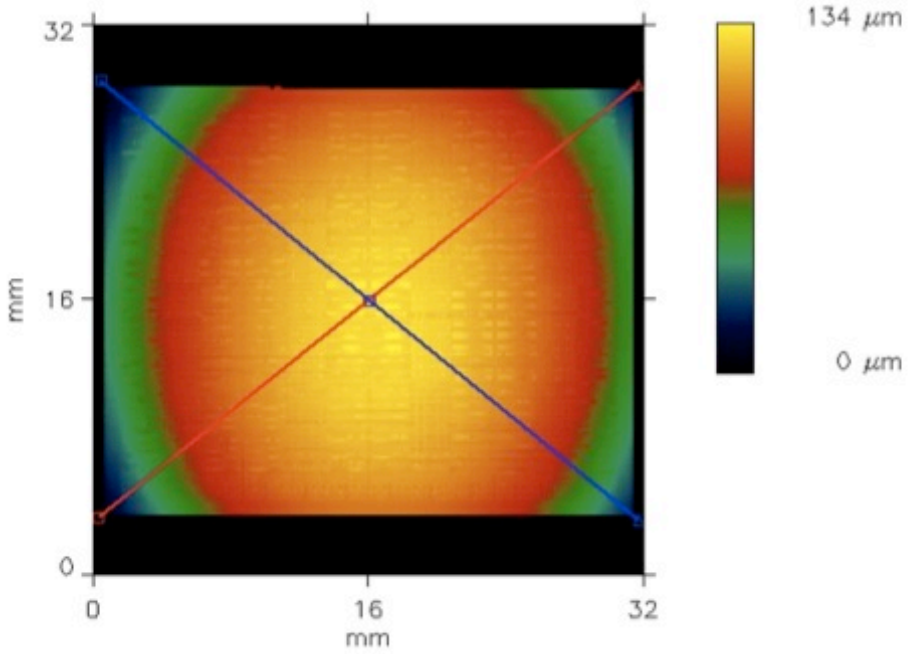


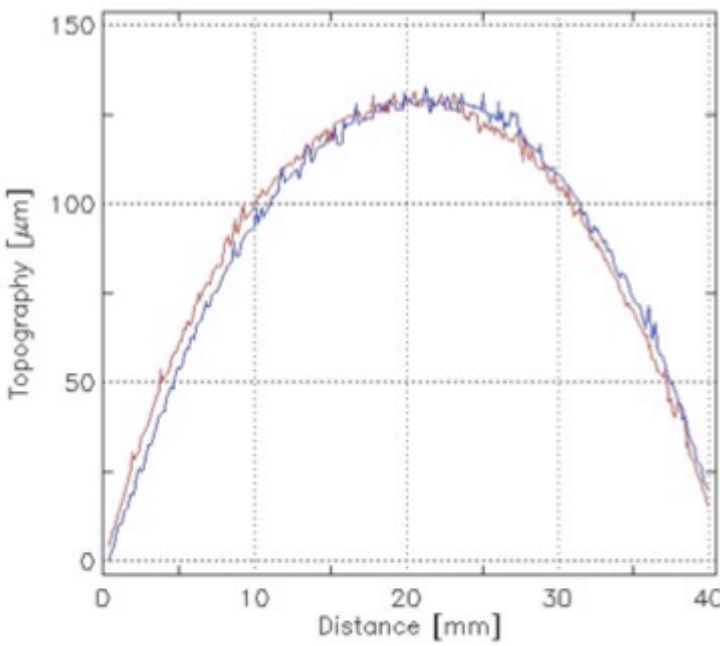
Porous Carrier

ITP on adhesive

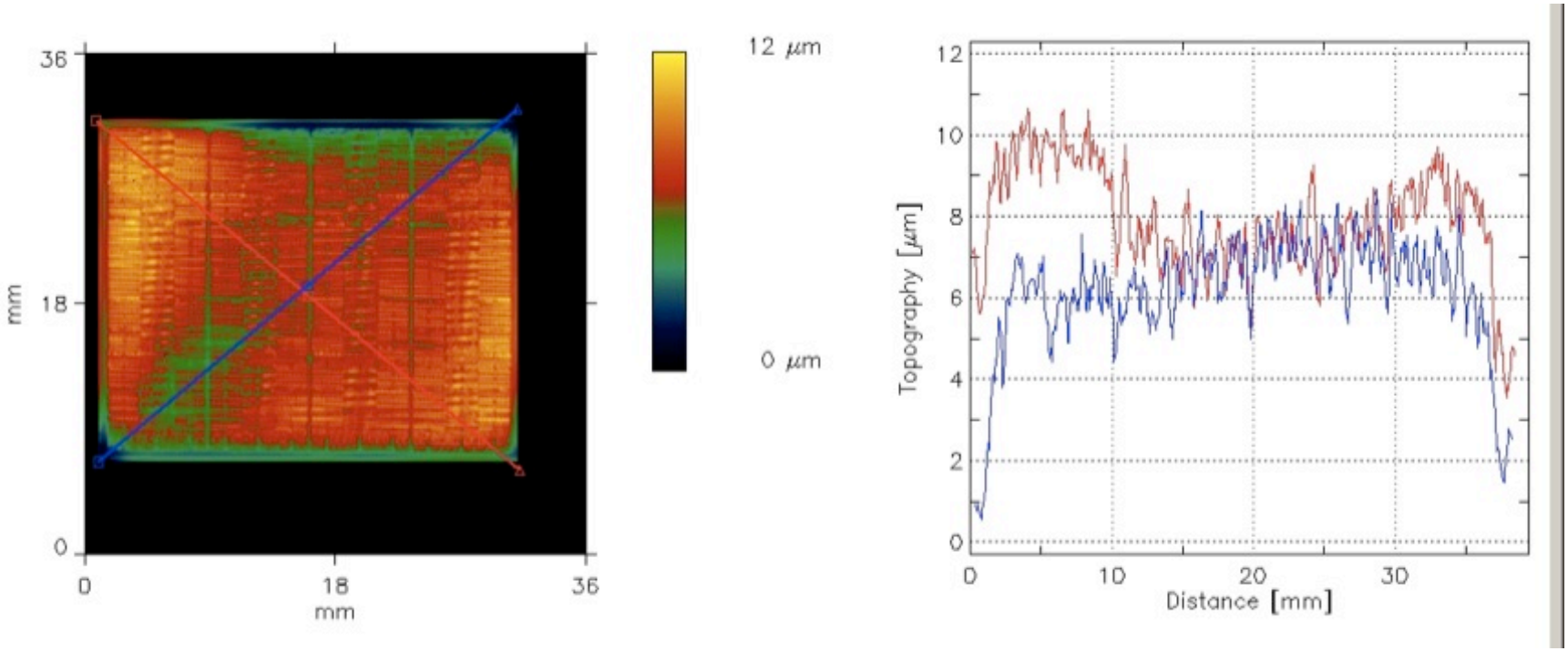
A = 0.5 – 0.8mm
B = 0.1 - 0.25mm
C = 0.5 – 1mm

Baseline ITP – Adhesive Bond





Bonded ITP – Bow Reduction



Post Processing - Cleans

- **Debond & cleans all occurred <15min, batch**
- **Cleans chemistry varied with adhesive, solvent to detergent**
- **Silicone film – solvent cleans**
- **High temp acrylic – detergent cleans**

Contact for More Information

- **DAETEC provides development, consulting, and technical training/support to solve manufacturing problems and introduce new options of doing business.**
- **Diversified Applications Engineering Technologies (DAETEC)**

  Camarillo, CA (USA) (805) 484-5546

  jmoore@daetec.com; www.DAETEC.com