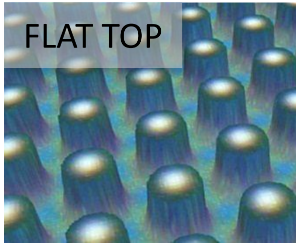
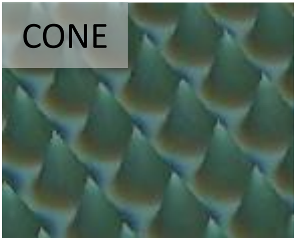
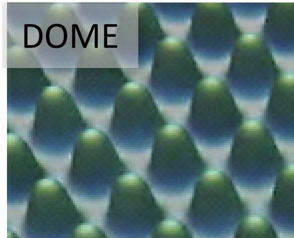
Patterned Sapphire Substrate (PSS) Applications

Zeta 3D Metrology Systems



High-brightness light emitting diodes (HB-LEDs) are often fabricated on sapphire wafers. Patterning the substrates with small structures greatly improves the light extraction efficiency of finished devices. PSS wafers also solve the critical problems such as crystal dislocations and refractive index mismatch.



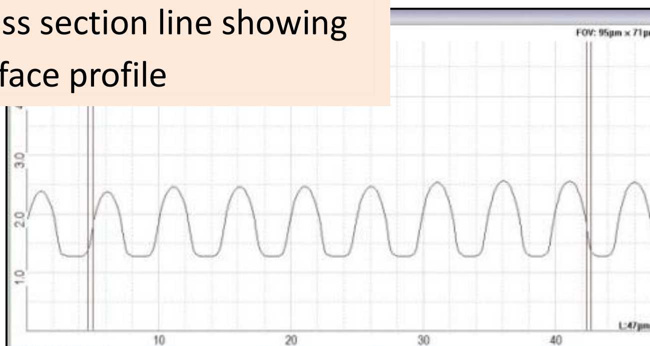


The Zeta-PSS Package provides rapid characterization of substrate bump features. Height, Width, and Pitch are measured in the same scan. Recipes are available for all types of substrate bumps: cone-shaped, dome-shaped, flat-topped, or photoresist.

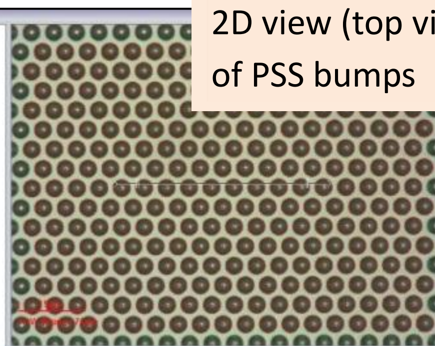
◄ **Example scans on a Zeta Optical Profiler system**

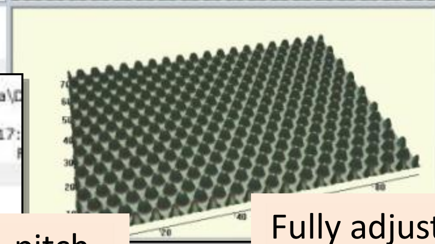
Automated Feature Analysis

Cross section line showing surface profile



2D view (top view) of PSS bumps





Fully adjustable 3D view

Zeta Analysis Report
Image Name: Single Point Trial 1 File Name: \\ZMGARCHIVE\Data\D
Point\Single Point Trial 1.zmg
Date Acquired: Tue Apr 19 16:31:42 2011 Today: Tue Apr 19 17:
Z Range: 4.9µm No. of Steps: 200 Step Size: 0.025µm

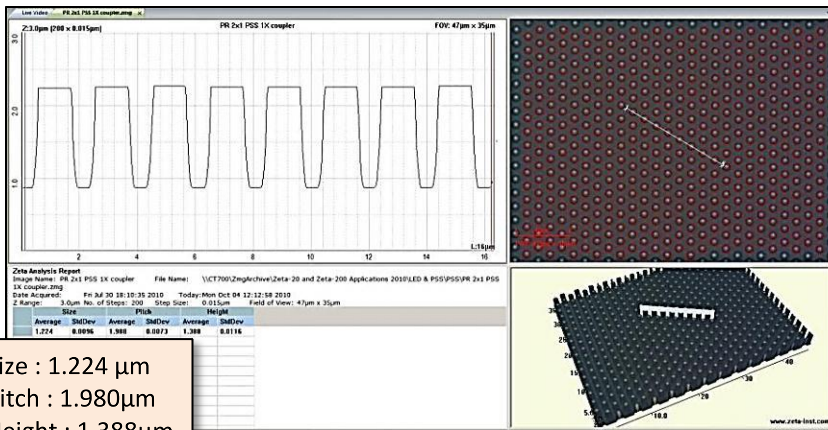
	Size [µm]	Pitch [µm]	Height [µm]	Space [µm]
Mean	3.680	5.026	1.481	1.346
StdDev	0.014	0.		
3 Sigma	0.042	0.		
Min	3.645	4.		
Max	3.725	5.		
Range	0.080	0.		
Count	270			

Statistics for width, pitch, height, and spacing of all features in field of view

Easy to use and production-ready

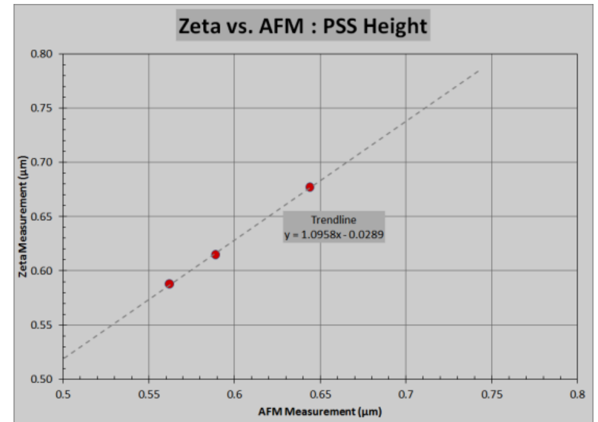
- The Zeta Optical Profiler takes a large area scan (70 µm X 90 µm) in seconds.
- Zeta 3D software produces a one-page analysis report that includes 2D and 3D images, a cross section, and statistical analysis of all features in the field of view.
- Numerical results are saved in spreadsheet-friendly text format.
- Automated X-Y stage and multisite recipes allow characterization of the entire wafer.

Exceptional Measurement Capability

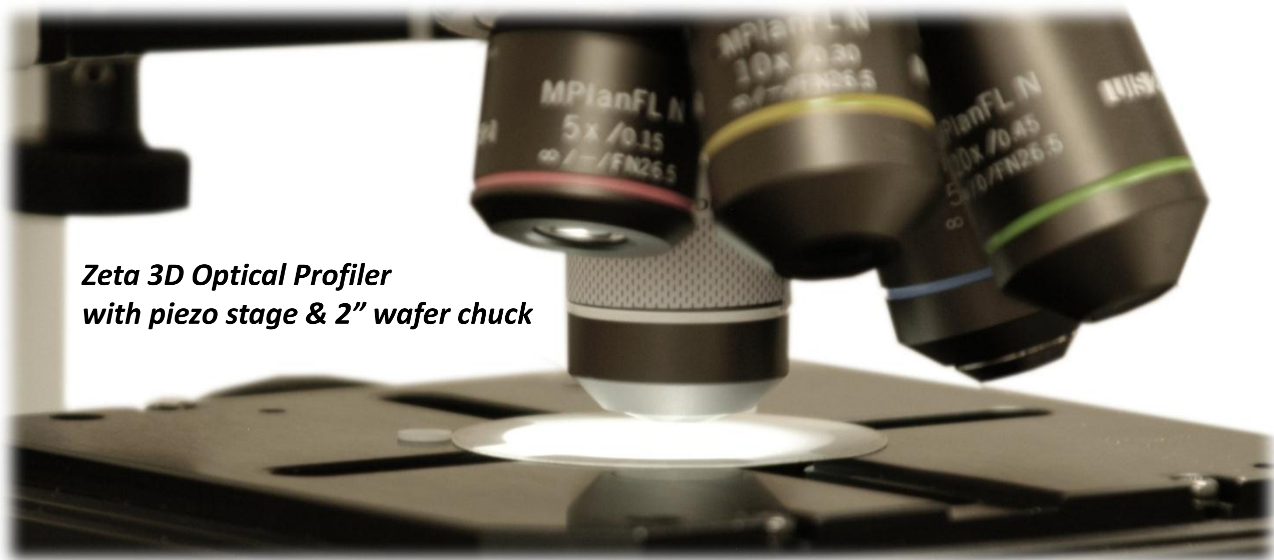


Optional Piezo Z stage provides 2nm Z-height resolution and 3s repeatability of less than ±15nm*

** As measured on a 1µm VLSI step height standard*



Zeta Optical Profiler measurements of height and width correlate well with AFM.



Zeta 3D Optical Profiler with piezo stage & 2" wafer chuck

PSS specific features and options:

- Manual load system for R&D and automated XY stage for production
- Vacuum chucks for wafers of different sizes
- Vibration and Environmental noise isolation package
- Piezo stage for 2nm height resolution
- True color 3D imaging enable review of defects such as scratches or missing bumps

Zeta 3D Software analyzes standard 2D or 3D wafer images for general surface characterization:

- Step height
- Surface roughness
- Feature size, diameter, area, and volume
- Wafer bow
- 3D surface visualization in true color
- Statistics

Customized PSS analysis software includes production-ready recipes for cone, dome, and flat-topped bumps. Hardware includes Zeta's unique PSS specific illumination optics.

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