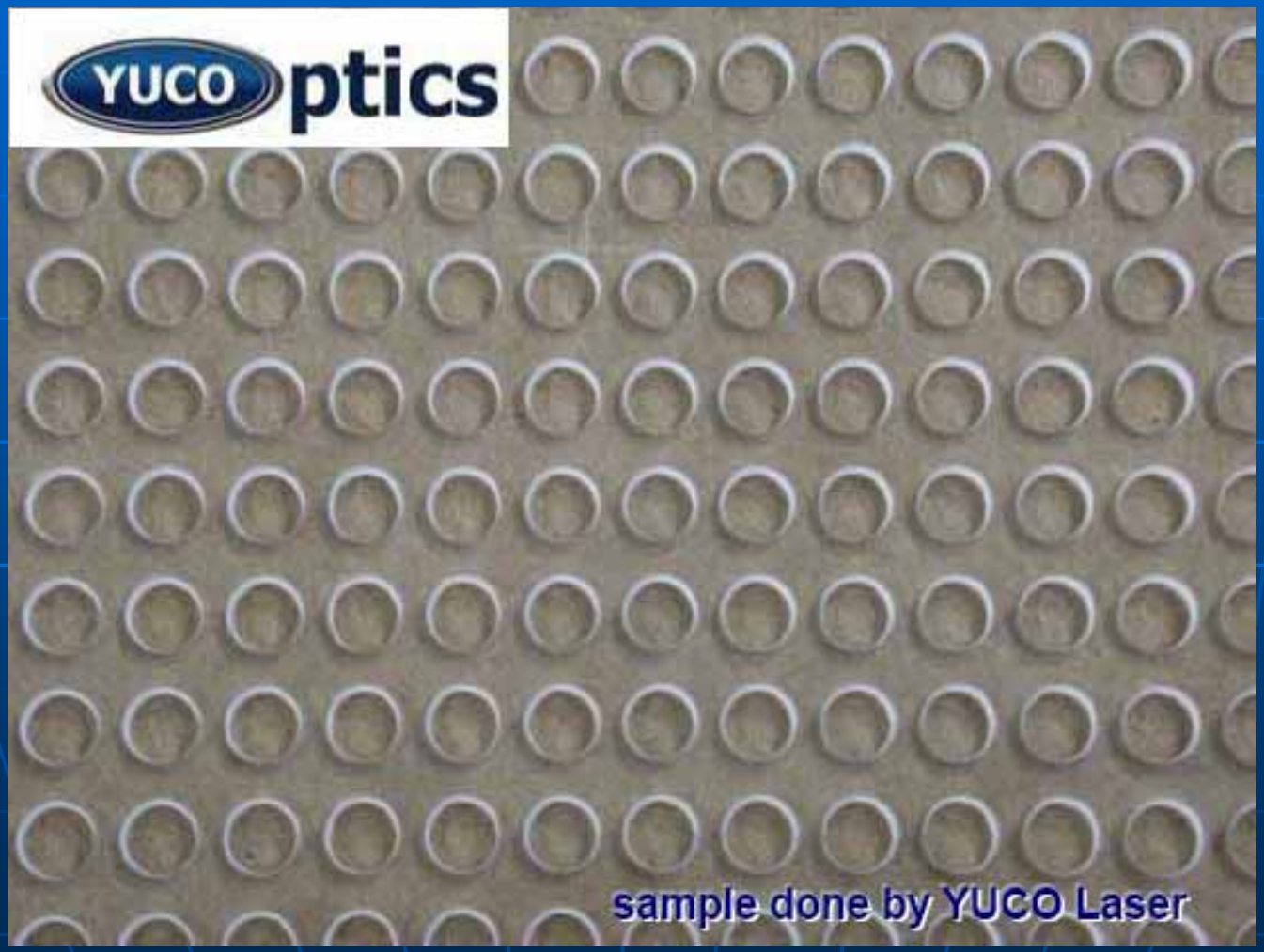
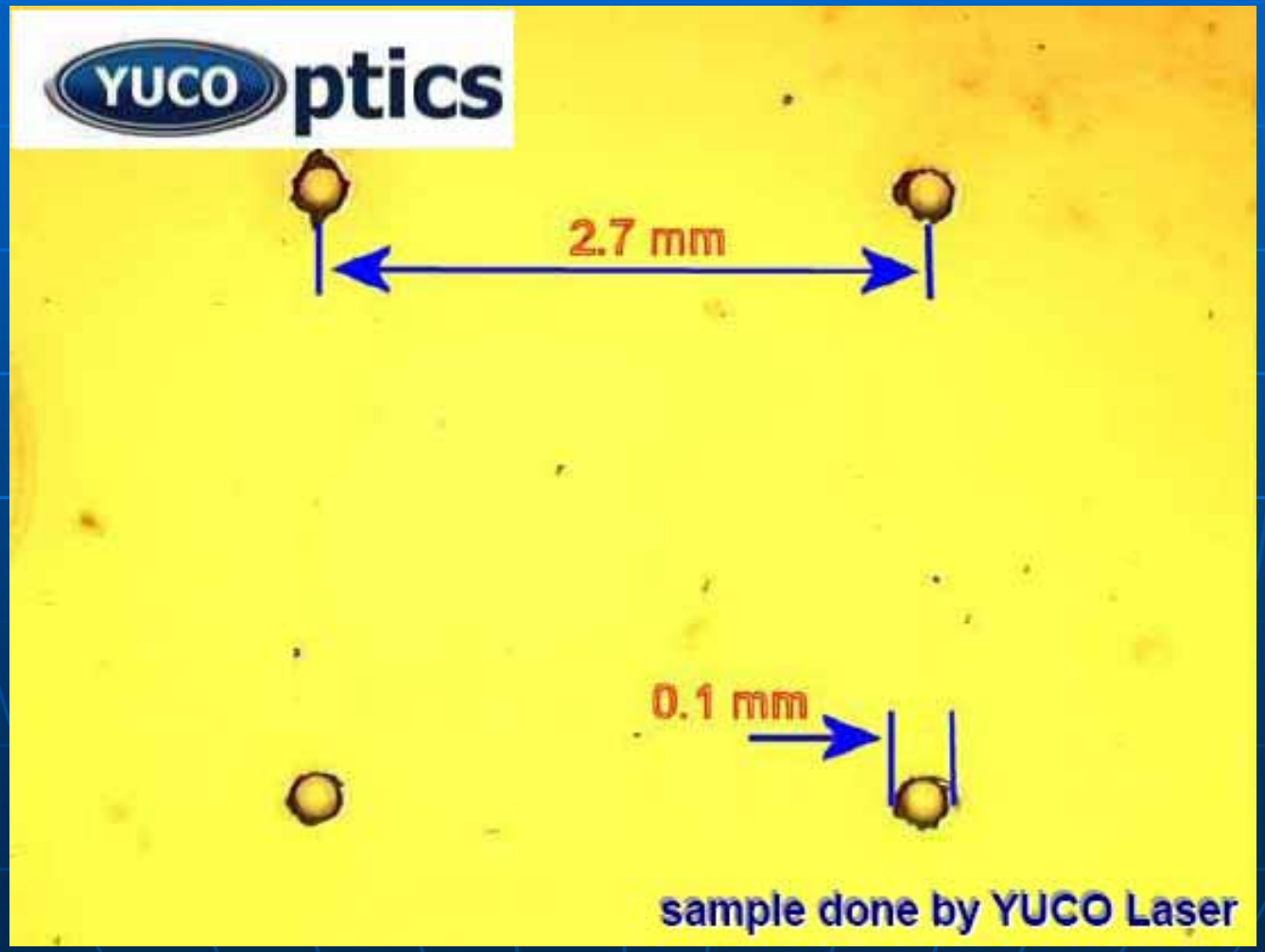
8 inches Glass Drill

（2 mm diameter， 1600 holes, 1.2 mm thickness）

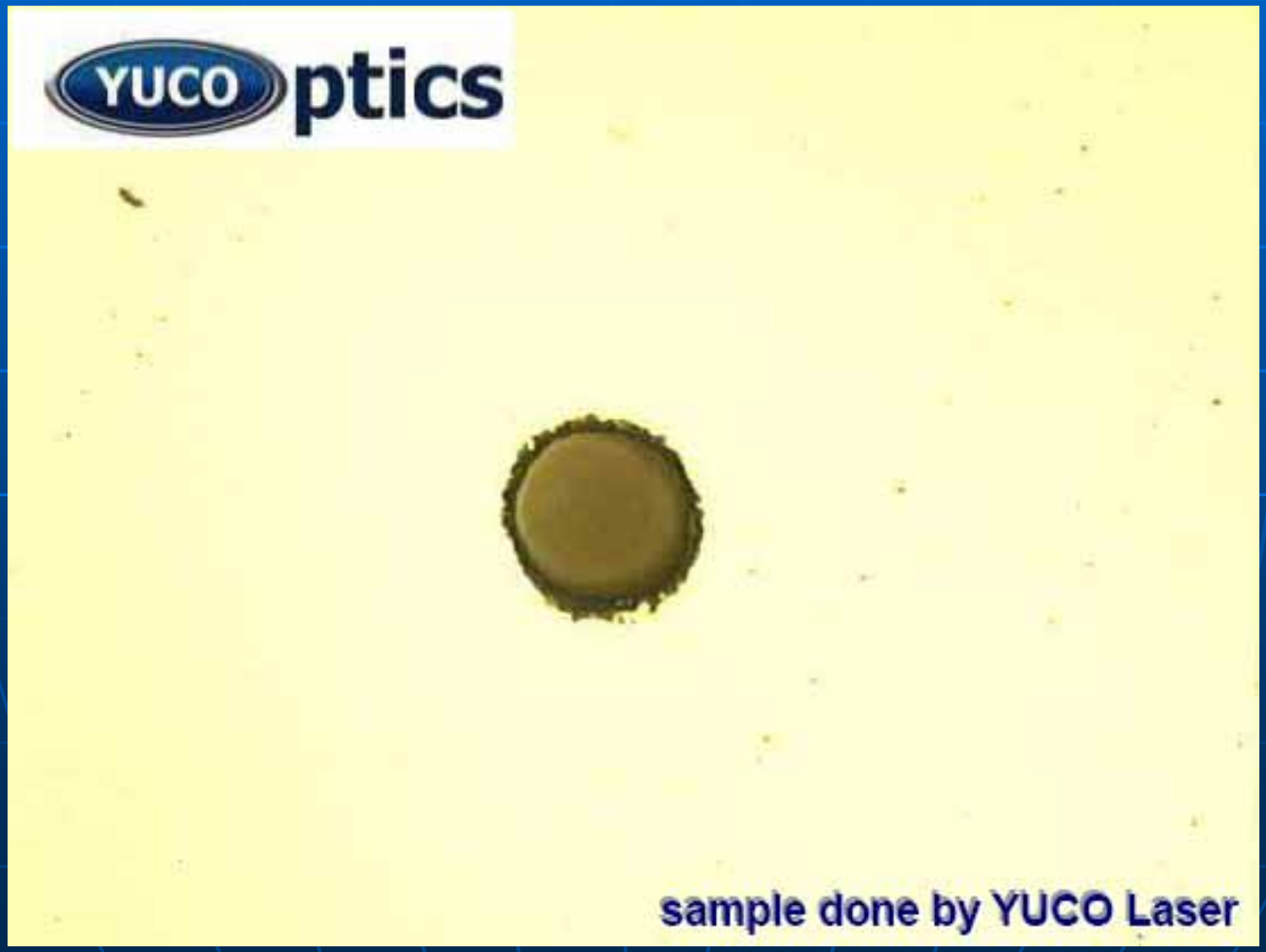
Glass Drilling



100um Pyrex Drilling Exit Bright Field 25X

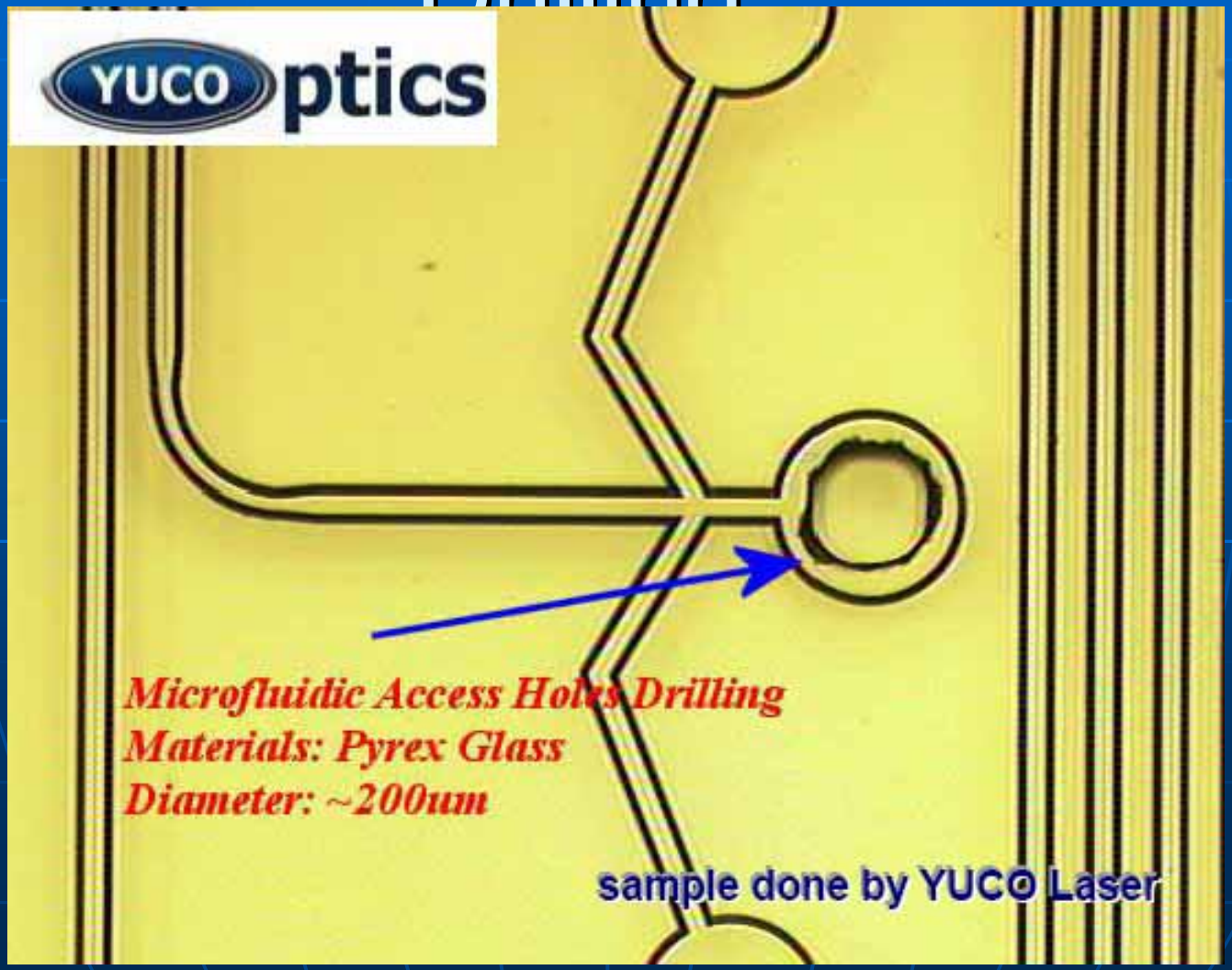


100um Wafer Drilling Entrance Bright Field 100X



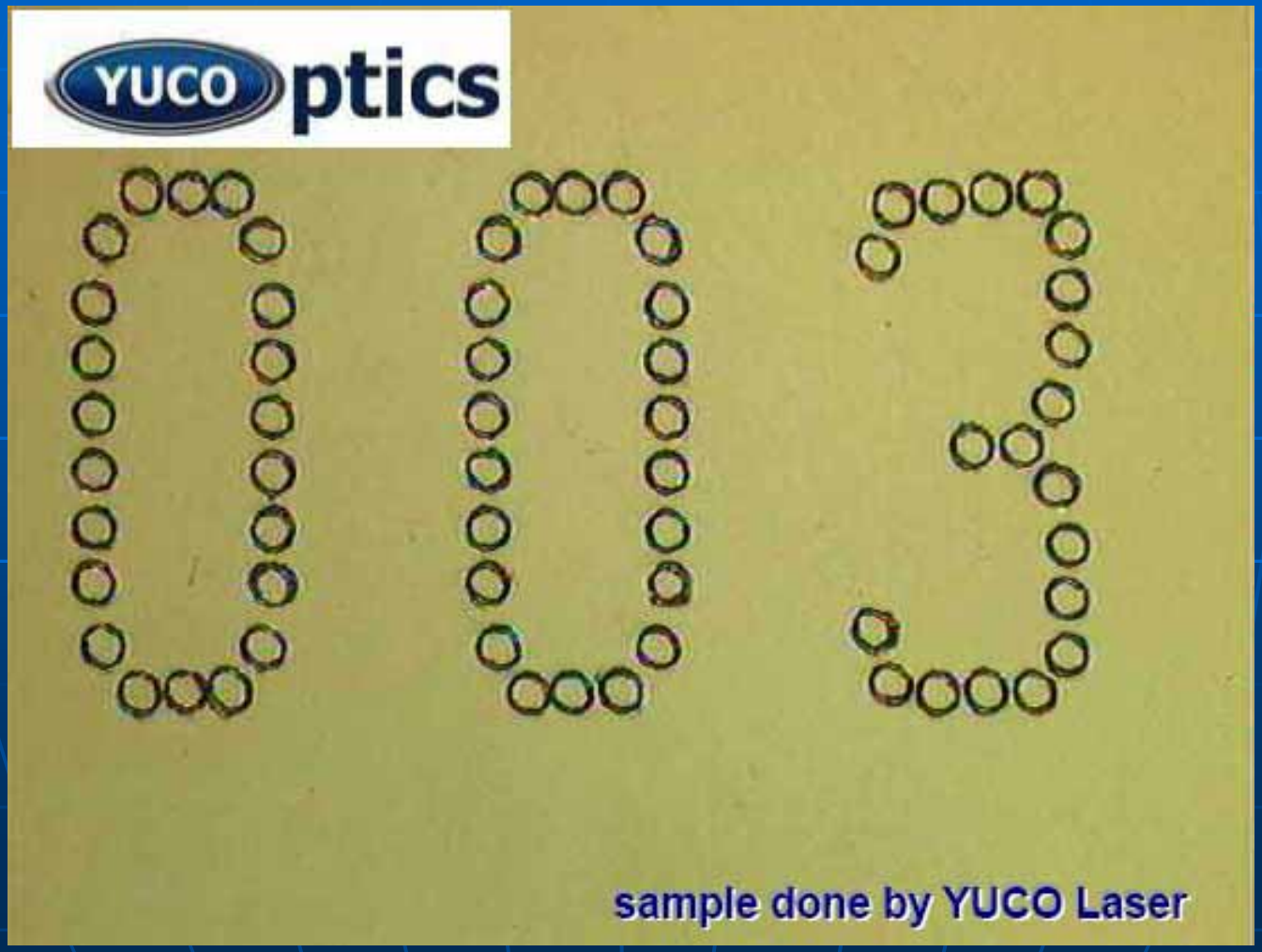
Glass Cutting for Square

Microfluidic Access Holes Drilling

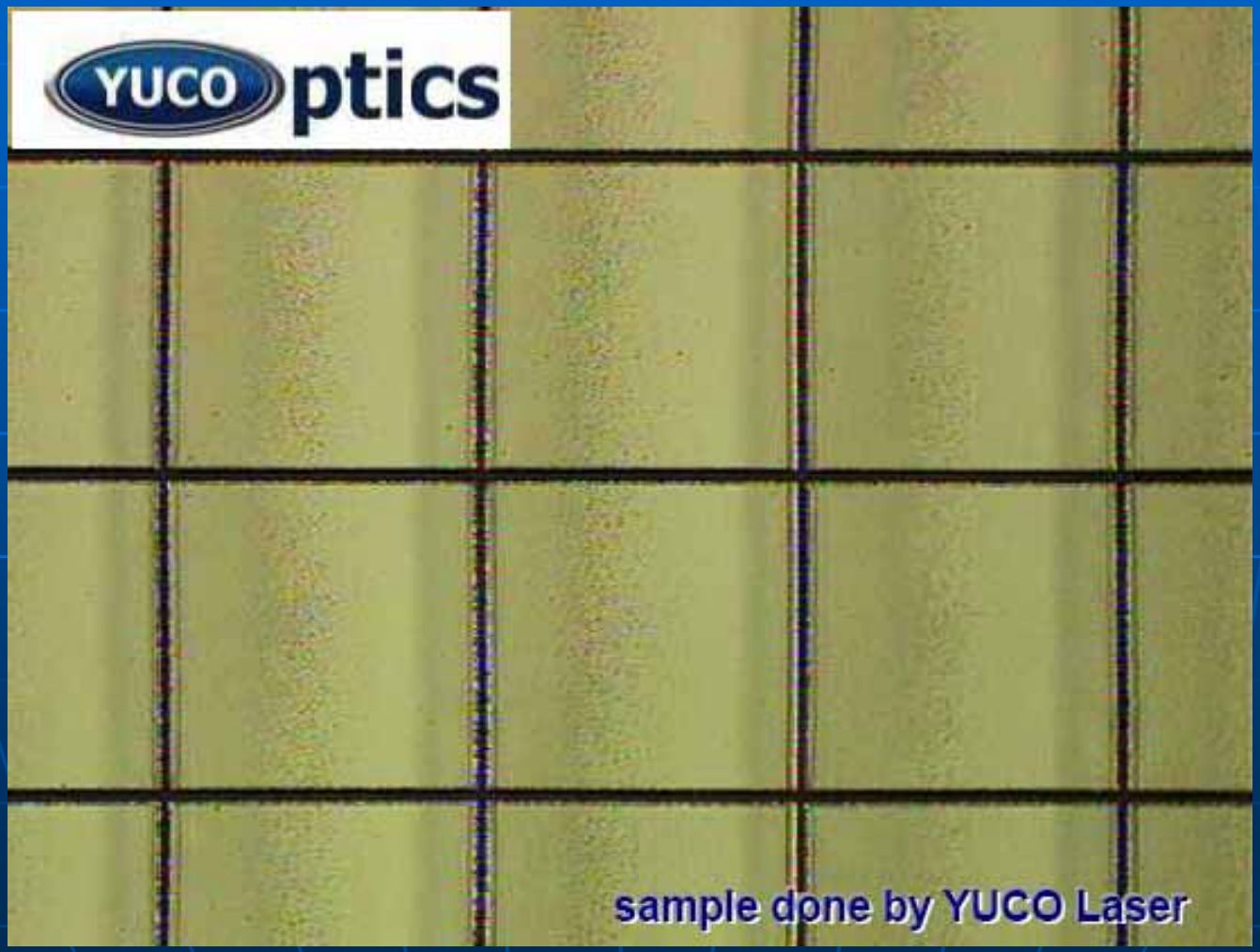


Saphhire UV Laser Dot Marking - 0.8mm Text High

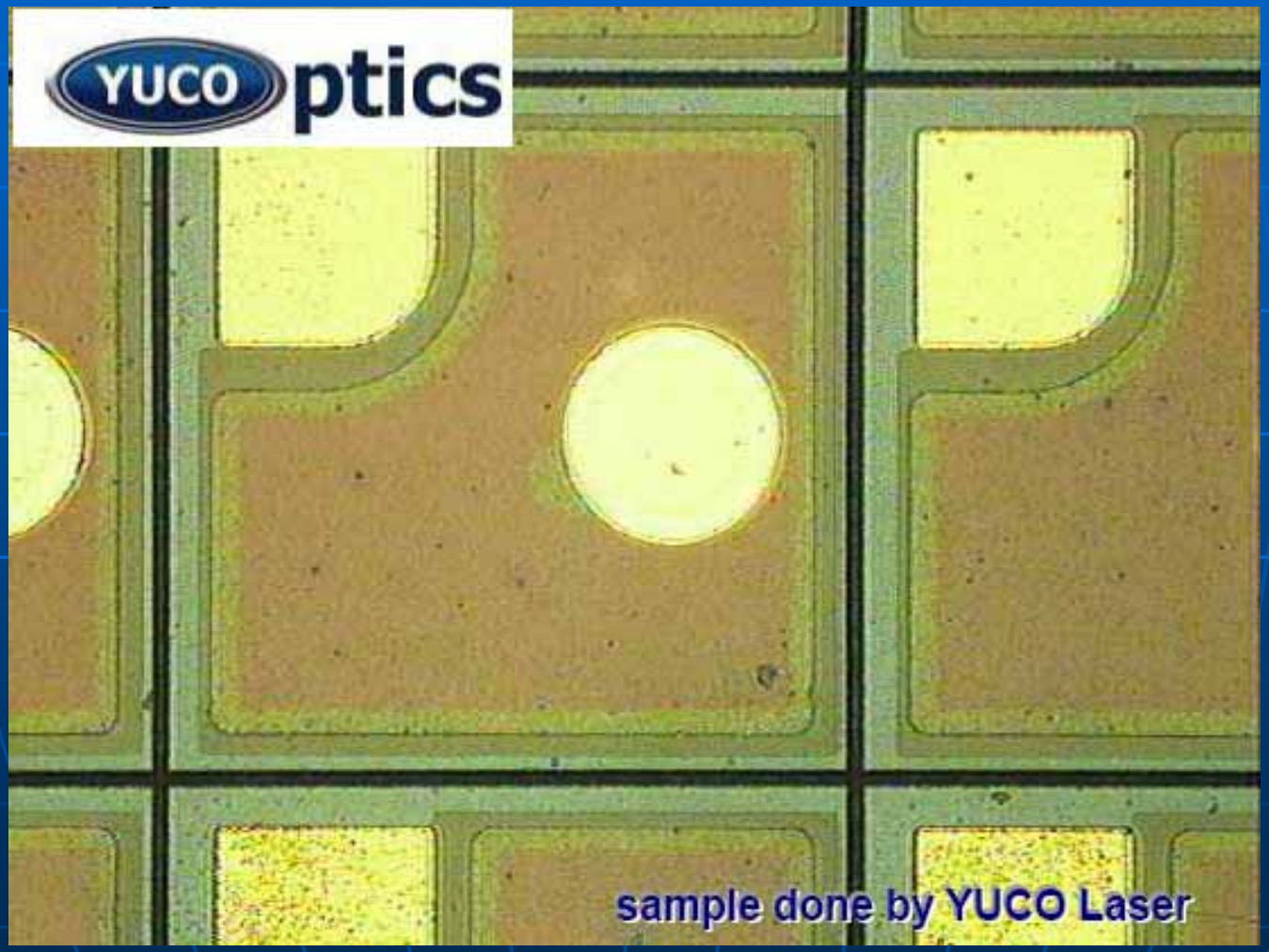
GaN Laser Marking



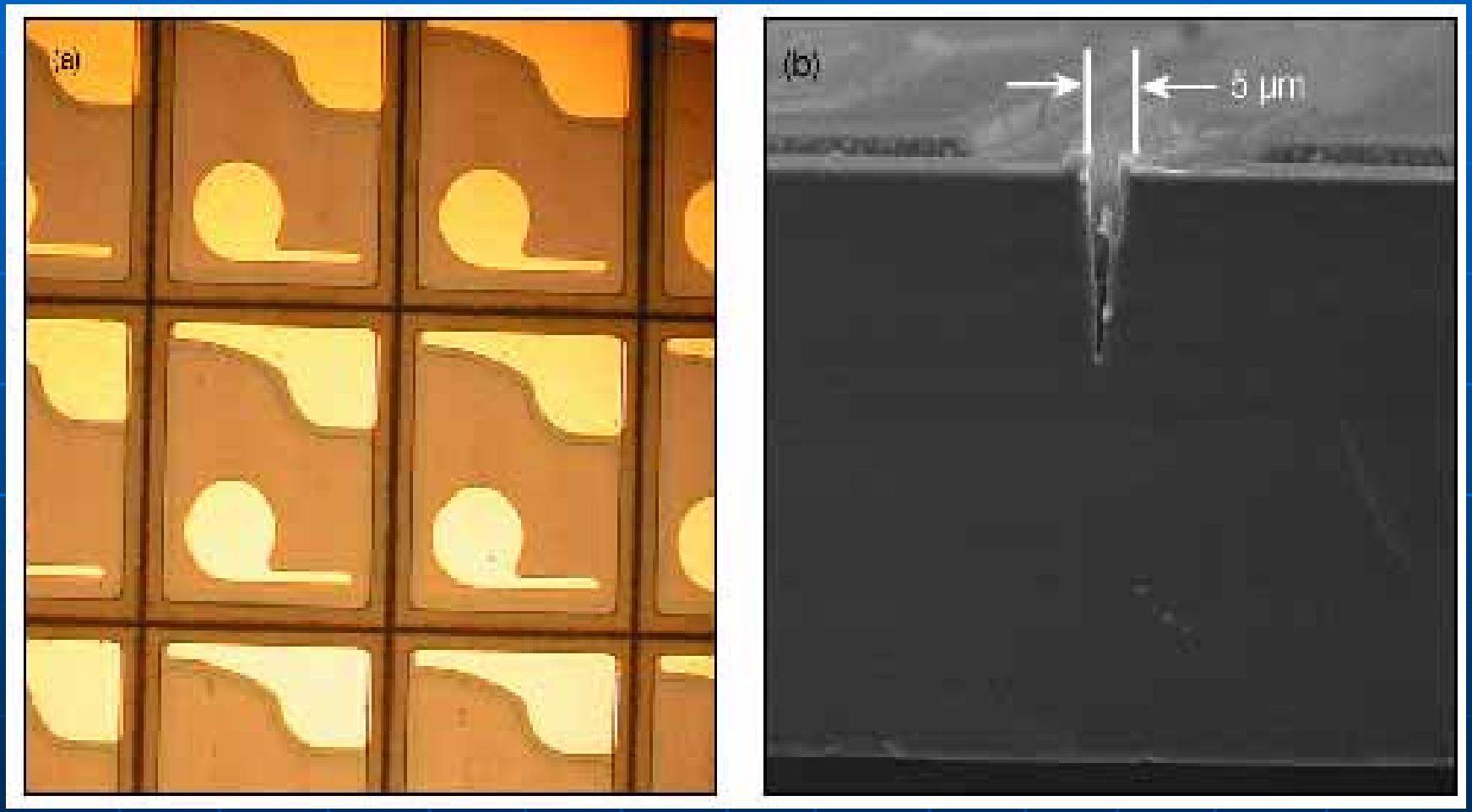
GaN Laser Scribing



LED Sapphire Wafer Scribing



LED Scribed by 266 nm laser



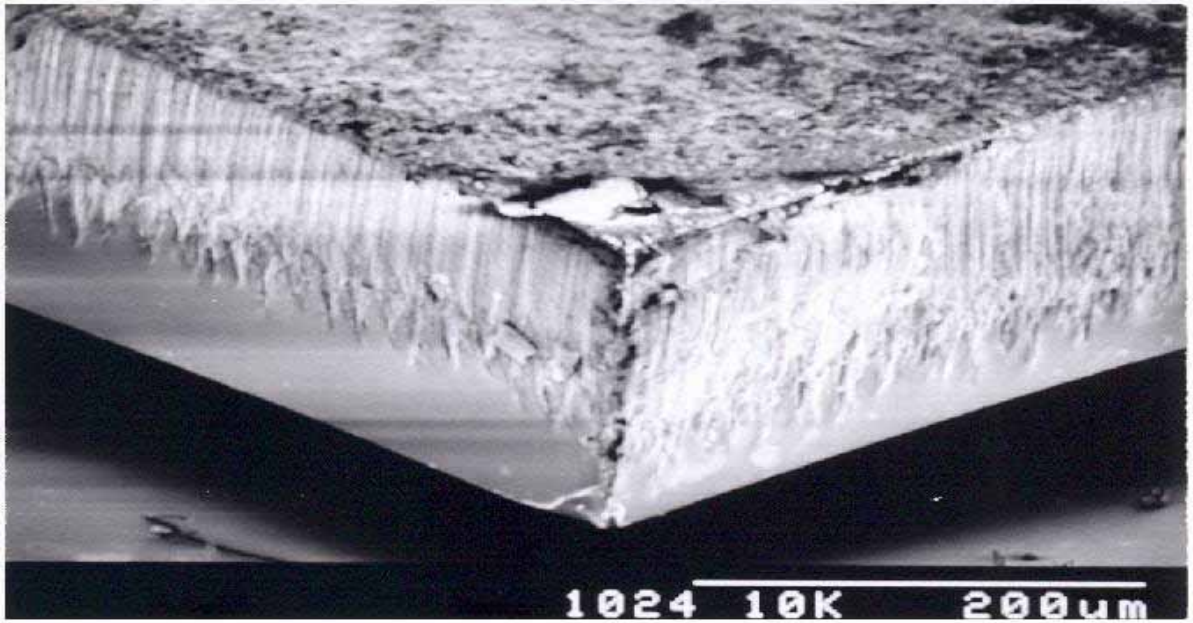
Comparison of Sapphire Wafer Scribing Process

Comparison of sapphire wafer scribing processes

	Diamond scribing	*Excimer laser*†	*DPSS laser*‡
laser wavelength (nm)	N/A	248	266 & 355
cut width (μm)	~1–2	15	~5
cut depth (μm)	N/A	30–35	30–35
throughput (wafers/hour)*	1	3	5
die yield	<90%	>99%	>99%
operating cost ($/wafer)*	80	8	<2
uptime (including maintenance)	~90%	>97%	>99%
process automation	manual	fully automatic	fully automatic

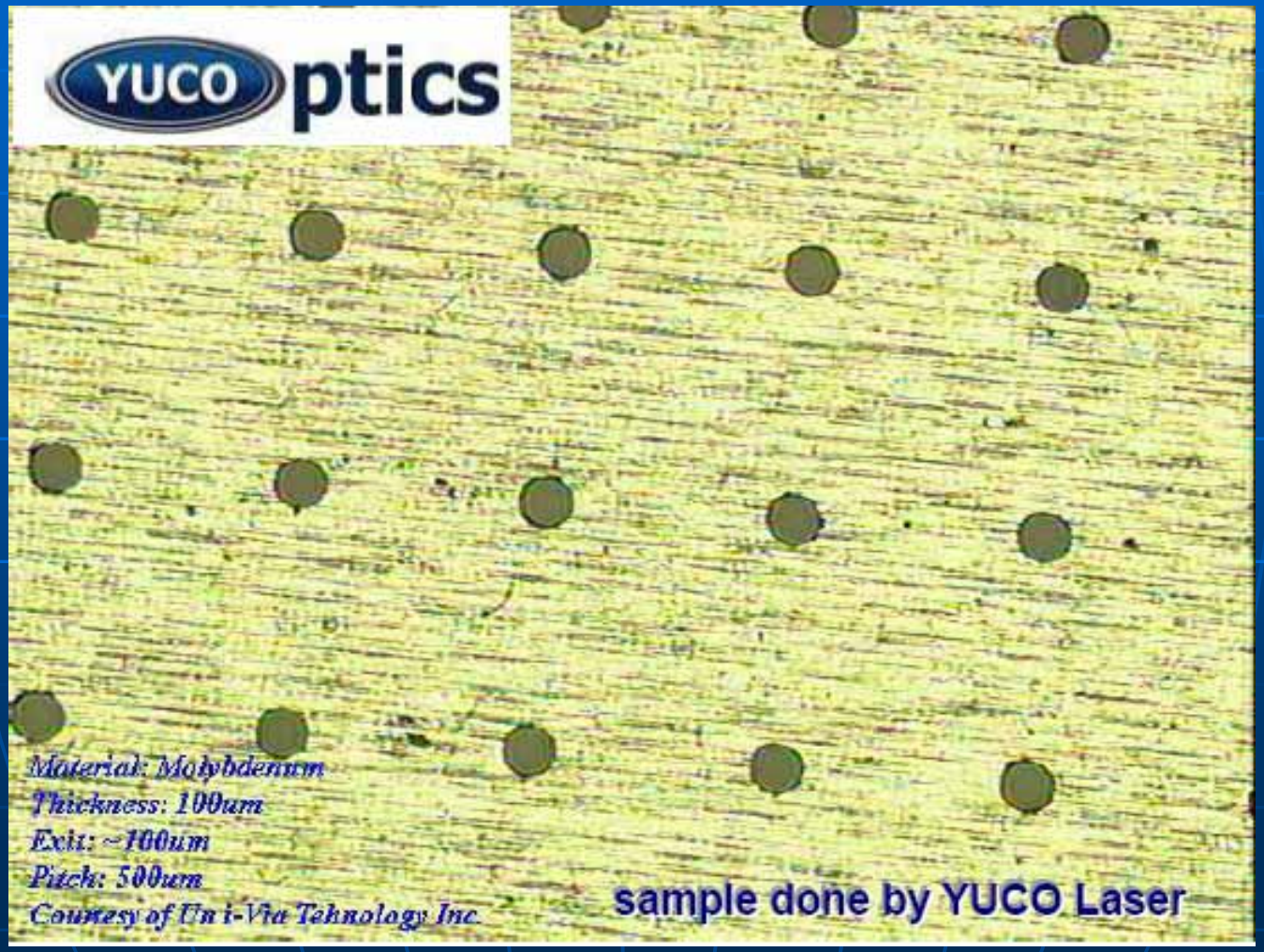
**Assumes a typical 2 inch diameter sapphire wafer with 350 μm × 350 μm die pitch. †Based on JPSA IX-1000 ChromaDice excimer laser scribing system. ‡Based on JPSA IX-300 ChromaDice II DPSS laser scribing system.*

Sapphire Deeply Scribed by Using 355 nm Laser

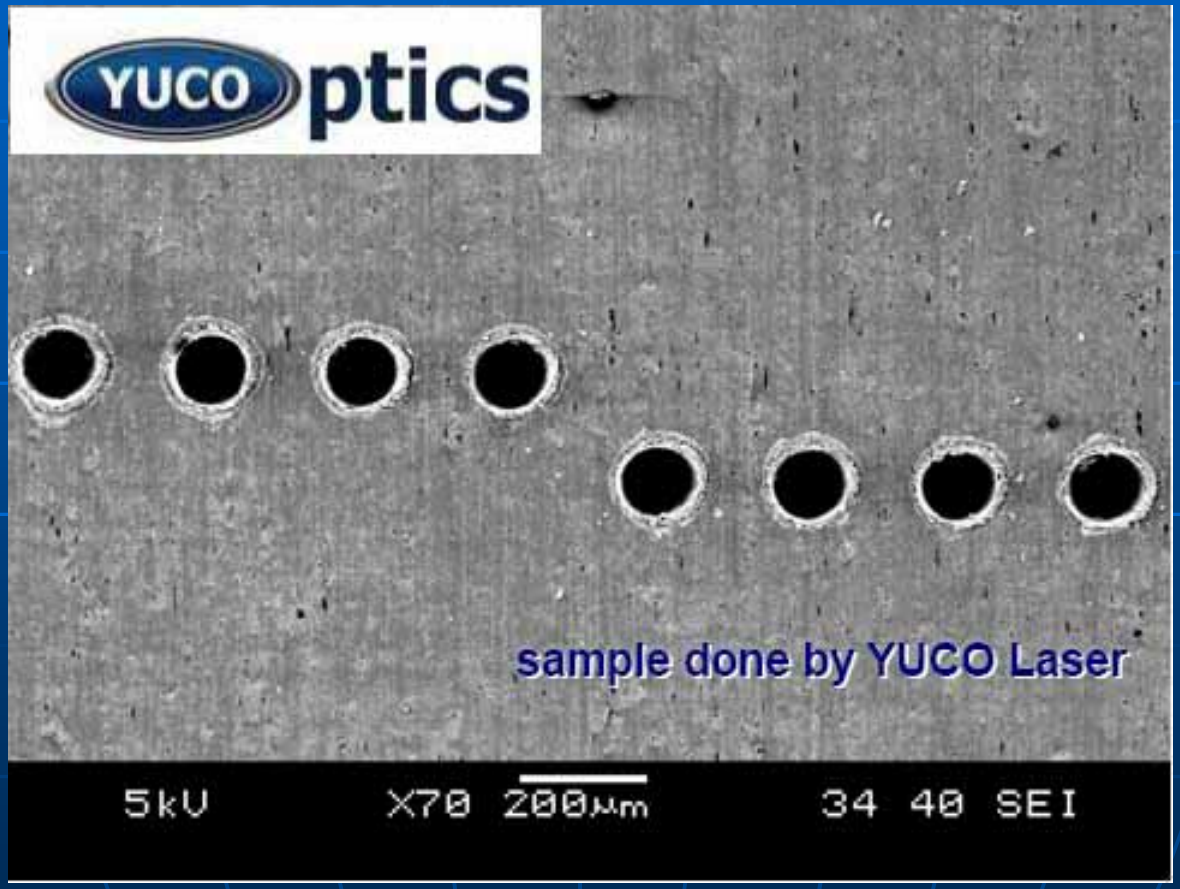


Ceramic Breaking

Molybdenum 100um exit



Molybdenum Laser Drilling 100um



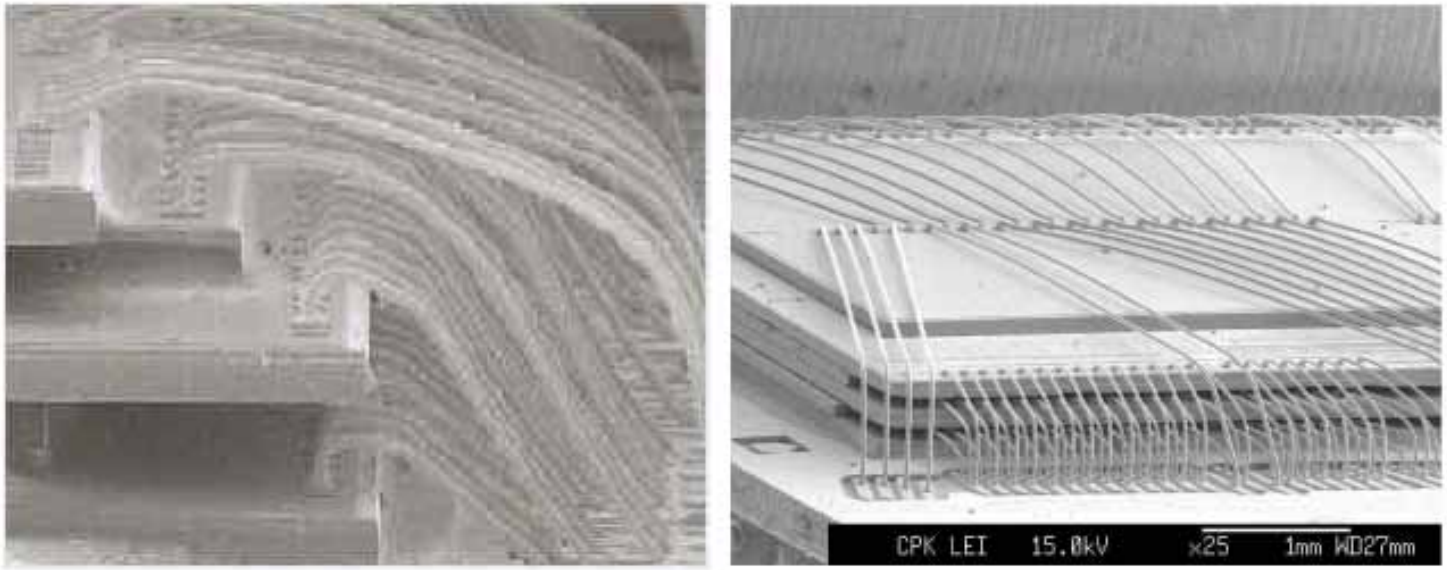
PCB Cutting

BGA Stencil

YUCO ptics
sample provide by YUCO customer
5kV
X25
1mm
14/NOV/03

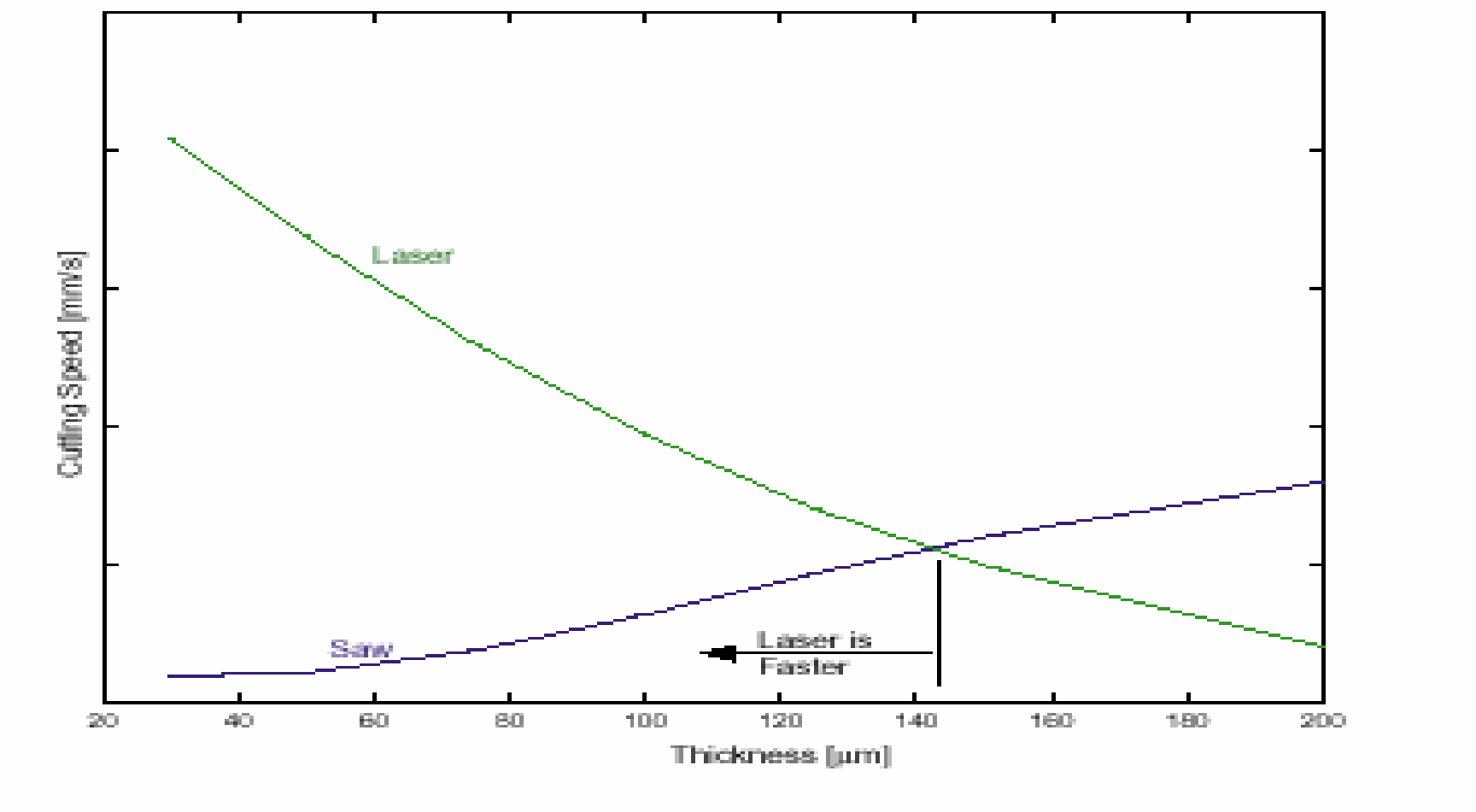
Silicon Cutting

3-D Wafer Level Packaging



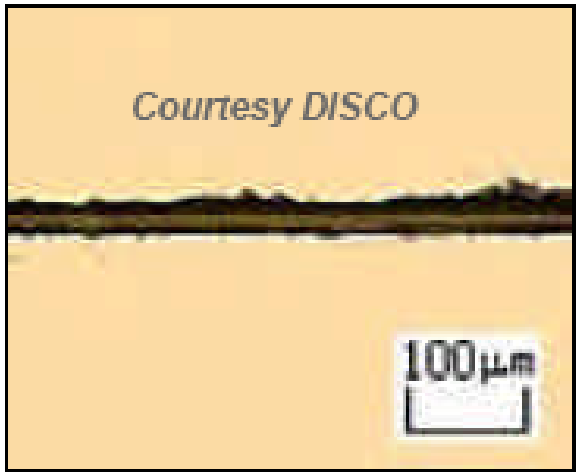
(a) (b)

Dicing Speed of Diamond Saw and UV-DPSS

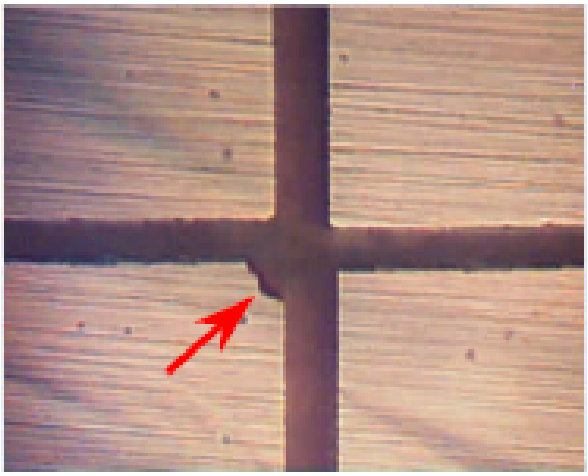


Chipping of Diamond Sawing

(a) 25 um (b) 40 um

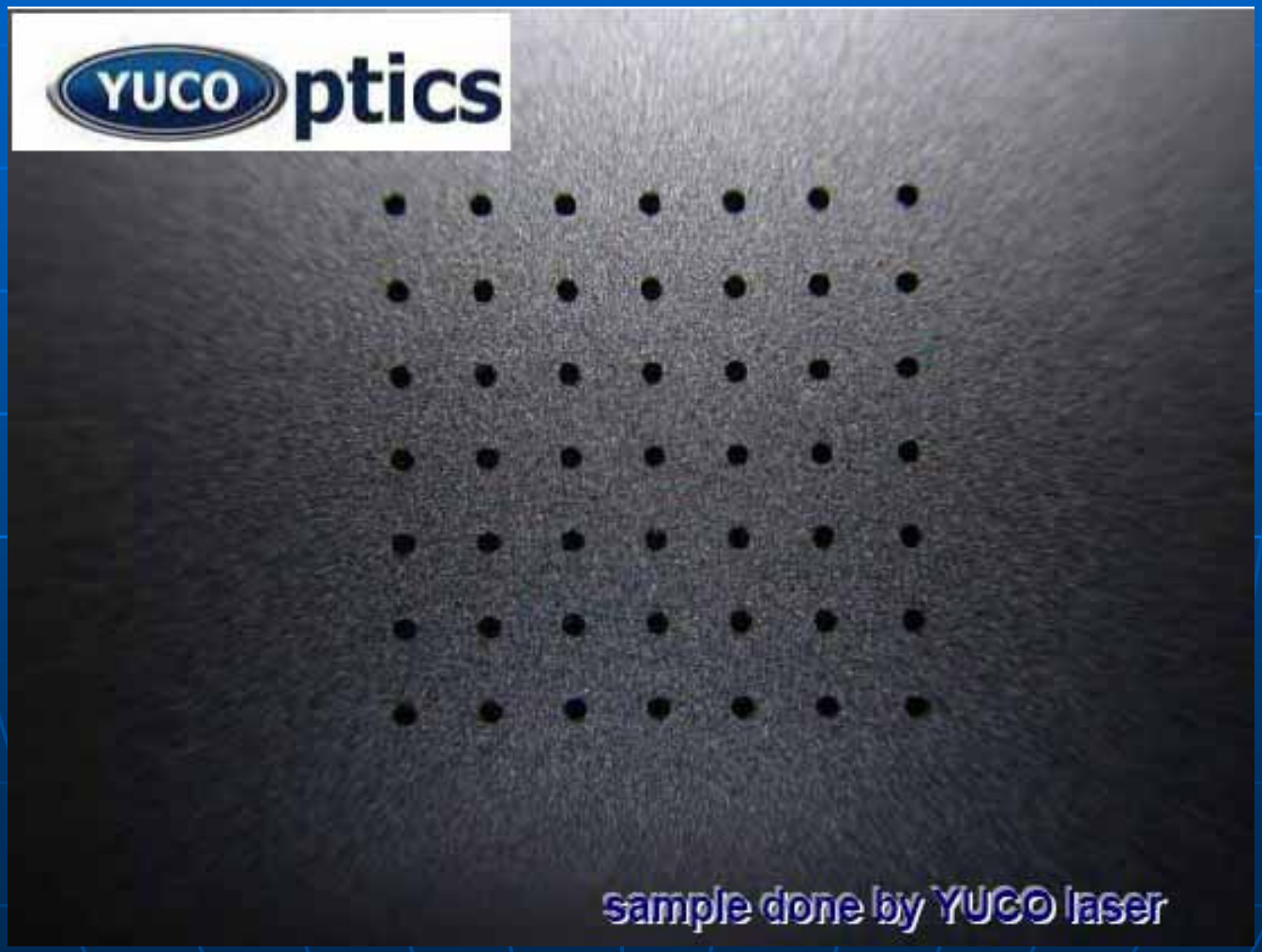


(a)

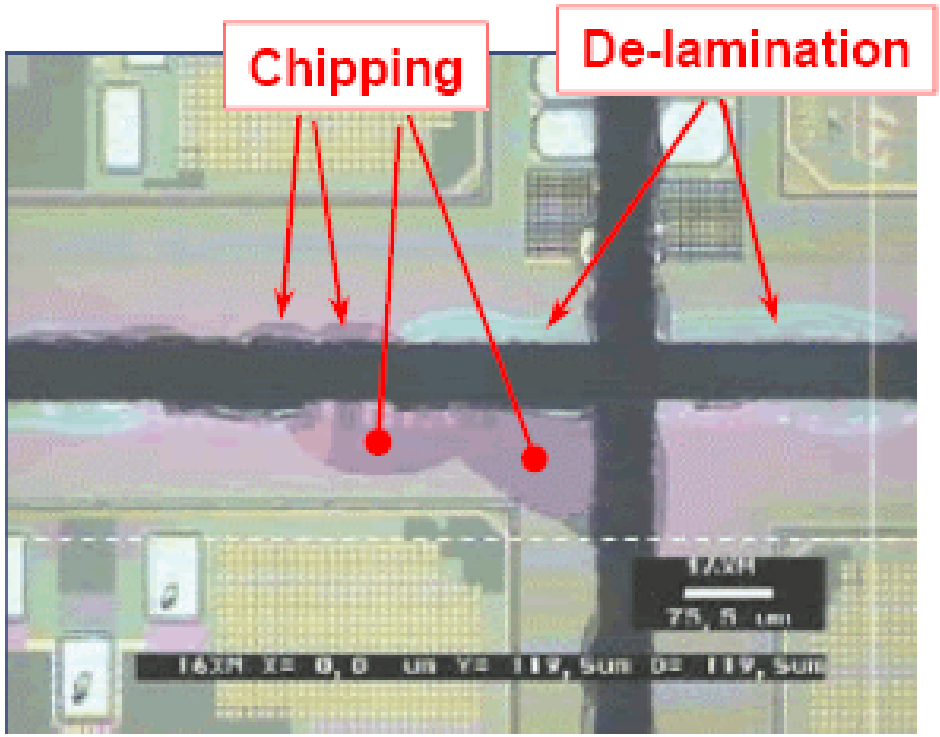


(b)

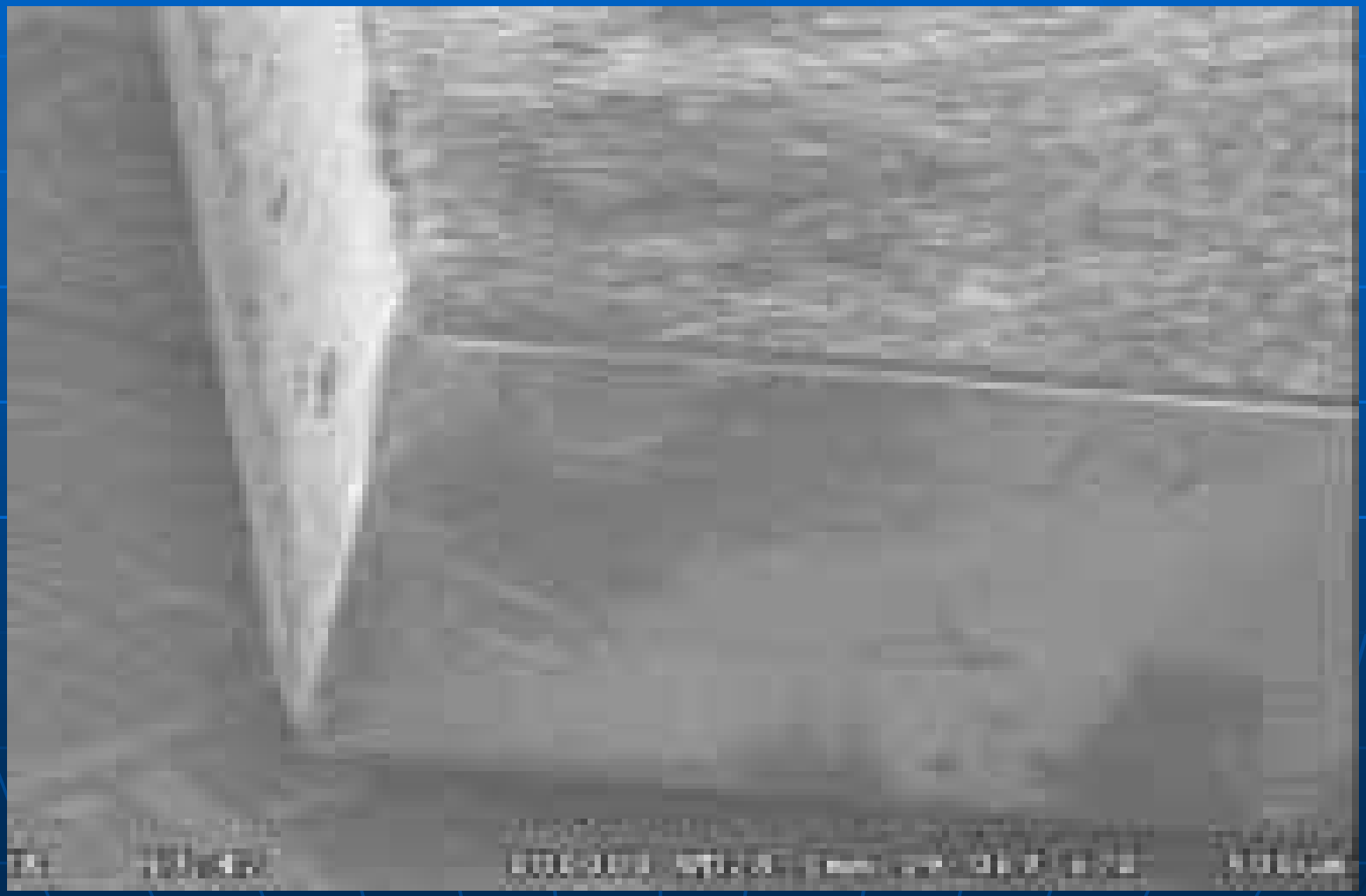
Silicone Wafer Drilling



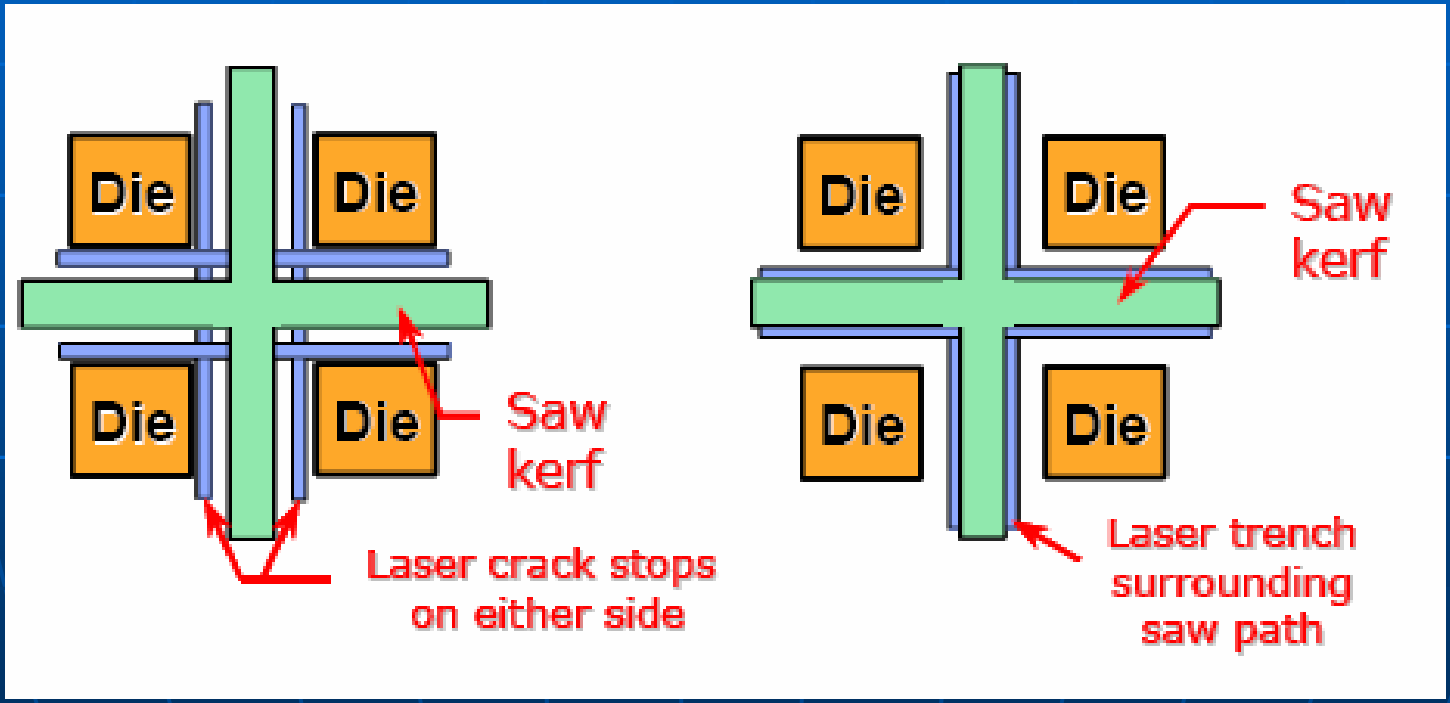
De-lamination of Low k-layer Caused by Diamond Sawing



Silicon Wafer Cut with UV Laser



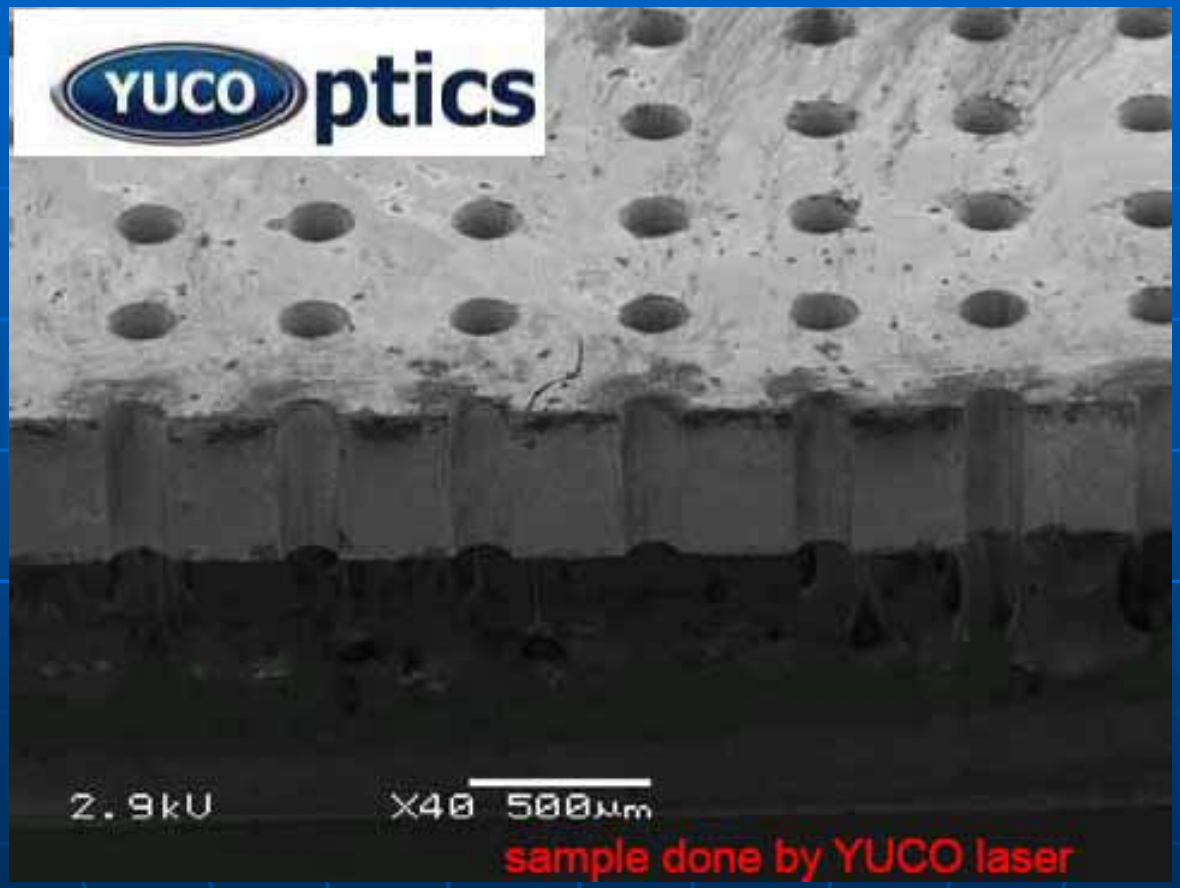
Hybird Sawing Technologies



Silicone Wafer Drilling

Silicone Wafer Drilling

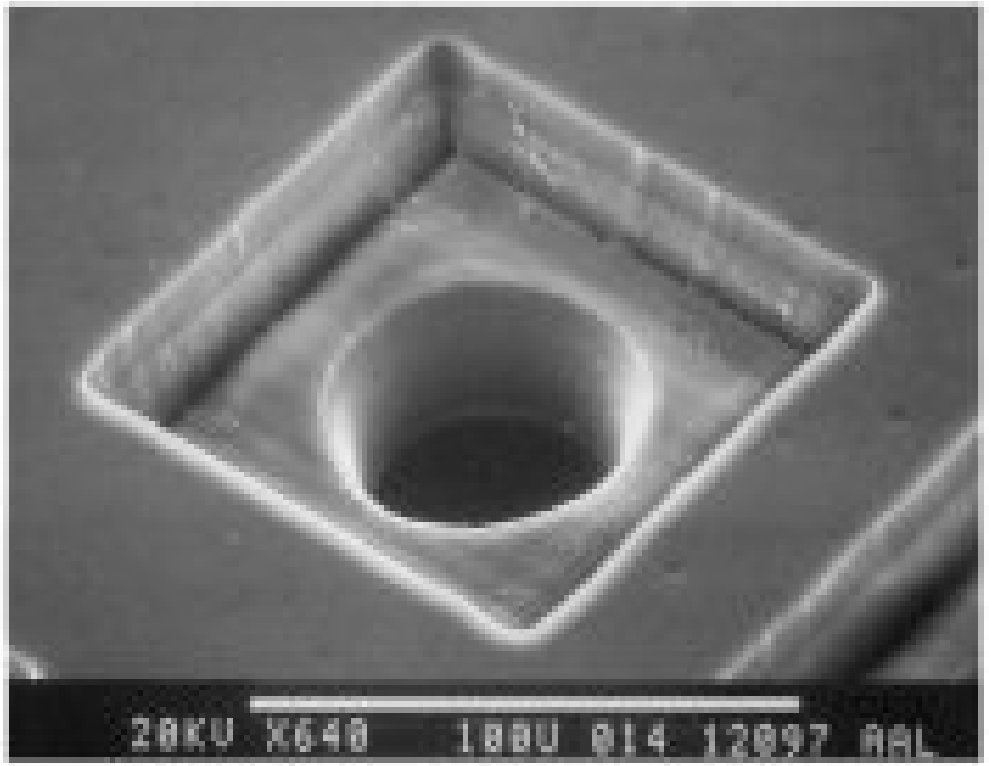
Silicon drill 100um straight holes



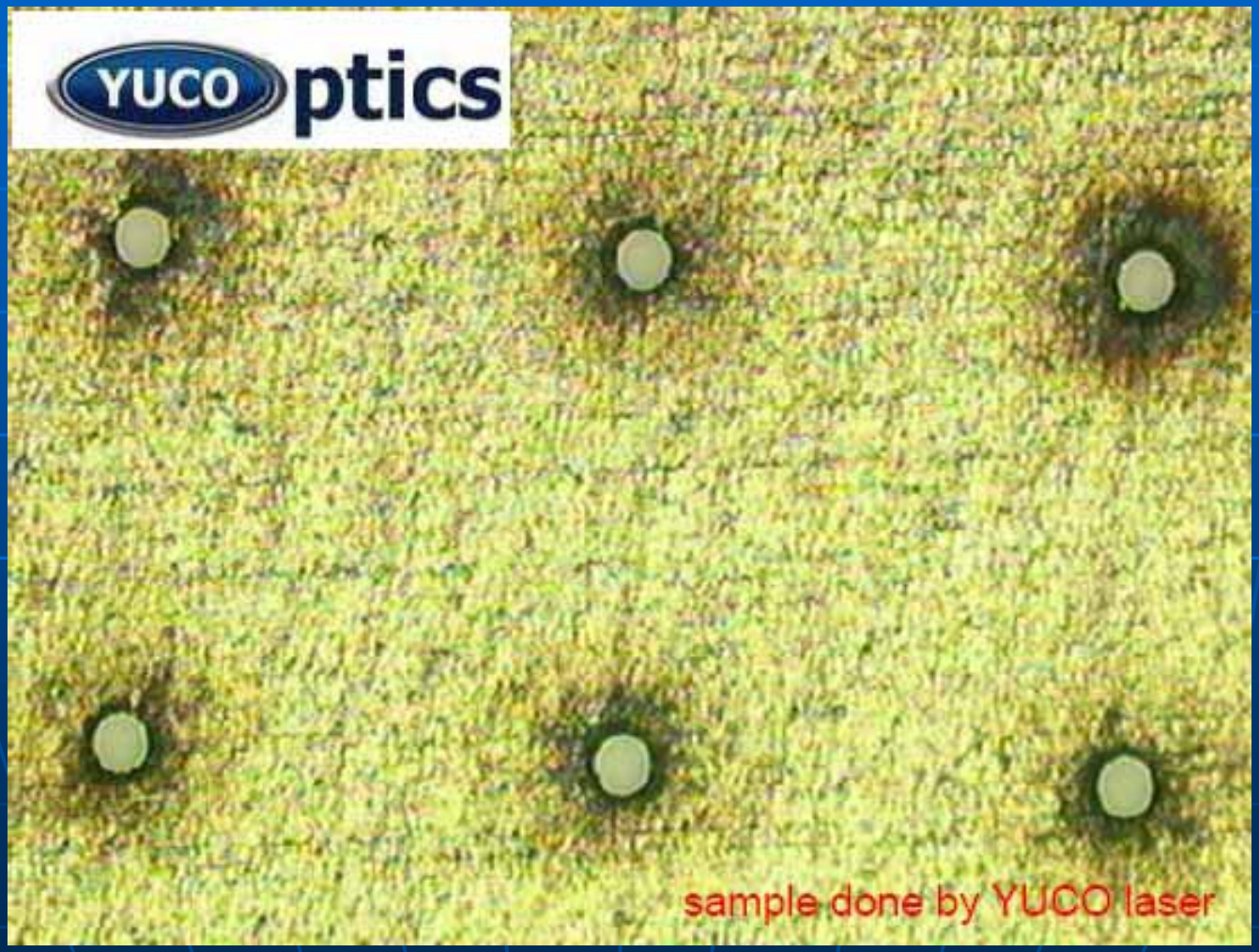
Silicone Wafer Cutting

Stainless hole drilling for Jet Nozzle

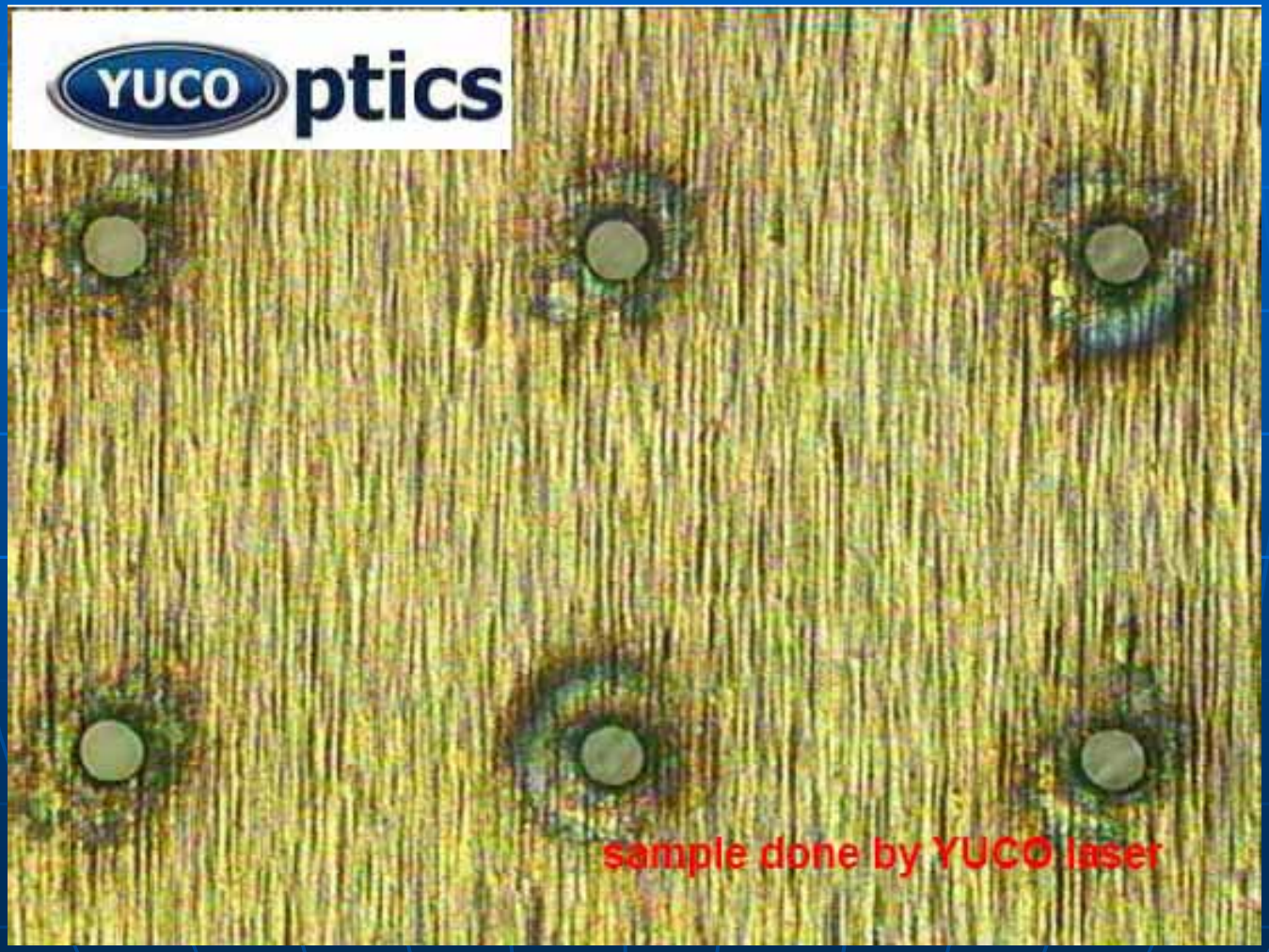
Counter-bored ink-jet nozzle (a 30µm exit hole)

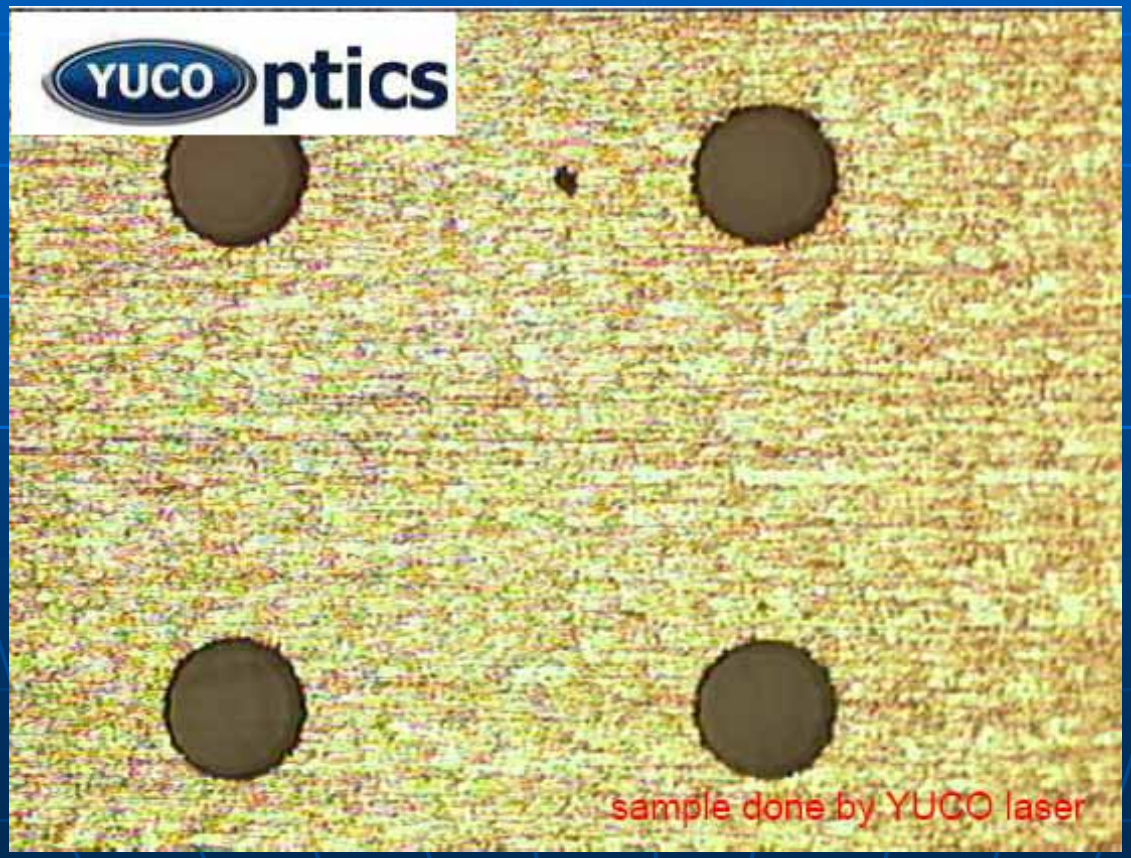


Stainless Steel Drilling



Titanium Drilling



Cu-FR4-Cu Drilling

100um via - 200um thickness,
45 um via - 75 um thickness