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LASERS



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Oxford Lasers manufacture guide plates for ProbeCards.

Figure 1: OL capability milestones.



We see demand for smaller holes on tighter pitches.

Figure 1 shows hole size vs pitch over the last six years for both circular (red) and rectangular (blue) holes.

In 2017 we were capable of drilling holes with 18µm land.

This poster describes our work to push towards 10µm land.



Materials and Methods

Our ProbeDrill laser micromachining system is at the centre of this development work. We have received government funding to support the continuous development of fine pitch probing (Innovate UK project PreciHol, #104127.)



These vertical guide plates are made from:

- Hard ceramics e.g. Silicon Nitride and Alumina
- Machinable ceramics e.g. Photoveel II S
- Polymers e.g. Polyimides



Figure 3: guide plate illustration

Figure 2: ProbeDrill laser micromachining system

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Metrology

Improving our metrology capability has been central to the advances made in small pitch hole arrays.

Figure 4 shows the Vision Metrology System we are developing to meet our exact requirements. It comprises:

- High accuracy air bearing XY stages
- Microscope objectives (multiple options)
- High resolution digital camera
- Most importantly: our purpose-built software

Figure 5 summarises the steps in analysing a single image. We have complete control over every part: illumination, thresholding, contour extraction, etc.





Figure 5: metrology data flow diagram.

Figure 4: Vision Metrology System, developed in-house for this application.



Results

Figure 6: holes with only 12μm land. Size 50 – 60μm. Entrance (top) and exit.



We have achieved 12 μm land in 250 μm Silicon Nitride.

Figure 6 (left) gives an example. No entrance breakdown.

Hole quality is comparable to production standard for:

- Size repeatability
- Position accuracy
- Corner radius

Our new processes are also improving capability:

- At other hole sizes
- In other thicknesses
- In other materials
- For circular holes

Figure 7: holes with corner radius < 4µm. Pitch is not the only metric we need to optimise.



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Discussion

ProbeCard customers want this:

Metric	Value
Land	Minimal
Taper	Zero
Corner radius	Minimal
Substrate thickness	>500µm
Size variation	Zero
Position errors	Zero

In reality, we are forced to make compromises.

For example, increasing the substrate thickness offers the following pros and cons:



Figure 8: ideal guide plate as viewed from side (left) and above.

Pros	Cons
More robust	Larger taper
Fewer plates in stack	Larger corner radius
	Longer drill times
Etc.	Etc.

Our development program is providing the data customers need to **make informed decisions** on this trade-off.





We have achieved 12 μm land in 250 μm thick Silicon Nitride.

Figure 9: $12\mu m$ land in 2018.



This breakthrough is enabling next-generation ProbeCard designs.

We are supporting our customers e.g. in choosing substrate thickness.

Development continues with the aim of pushing below 10µm land.



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