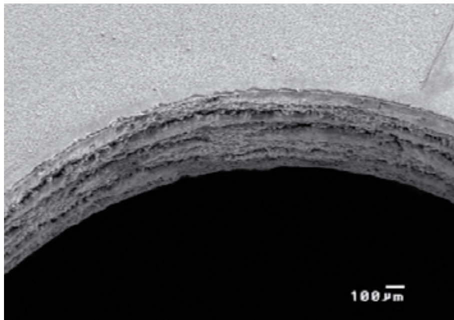
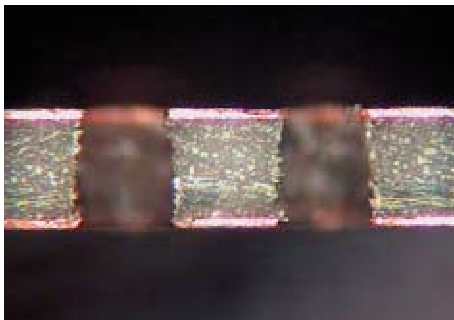
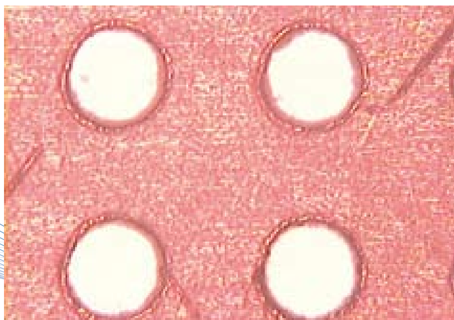
Application Report
LPKF MicroLine UV Laser Systems

Laser Cutting and Drilling of High-Frequency Circuit Board Materials







LPKF®
Laser & Electronics

High-precision laser cutting and drilling of high-frequency circuit board materials

High frequency applications demand for substrate materials with tight dielectric constant control (±1 to 2 per cent) and low electrical loss (dissipation factor less than 0.005). These days polytetrafluoroethylene (PTFE) substrates (thermoplastics, e.g. Teflon®) are the most commonly used materials in microwave technology aside from AL_2O_3 ceramics. For high volume applications in the low cost area (telecommunication, sensor technology) non-PTFE materials based on woven-glass-reinforced hydrocarbon and ceramic thernioset are available.

UV-laser processing enables cutting and drilling of clean contours and through-holes in these high frequency circuit board materials.

Cutting and drilling of through-holes is suitable for thicknesses of up to 1 mm. The focussed laser beam reliably cuts or drills through all base material layers in one or a few steps.

Because of the contact-free material processing, there is no distortion even when thin materials are used, as it might be the case when milling or punching out. In combination with the fiducial registration and online scaling, pre-existing distortions can be compensated for and the cut contours positioned precisely within the layout.

Due to the direct material vaporisation, the UV-laser minimises the formation of molten material to prevent burring and delamination of compound materials.

As a result, laser cutting creates precise, almost radius-free cut contours. The cut edges and through-hole walls are smooth and vertical. This guarantees a maximum of dimension integrity, edge quality and throughput.

Most importantly, the LPKF MicroLine UV systems are TÜV-certified for the laser processing of PTFE-based circuit board materials.

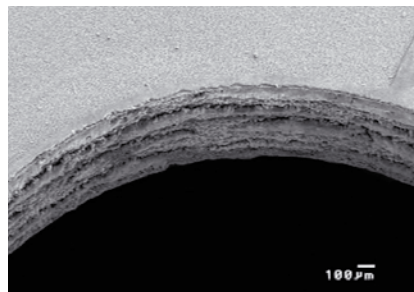
Advantages of laser cutting

- Clean cutting edges and through-hole walls, no burring
- Cutting of extremely fine contours
- Drilling of through-holes down to 75 µm diameter
- Virtually radius-free internal edges
- Minimal thermal stress, i.e. no delamination
- Cutting and drilling of various material thicknesses and combinations in one job
- Separation of assembled circuit boards
- Contact-free material processing to prevent material distortion
- No fixing device or protective cover necessary
- High precision und position accuracy of cutting egdes and through-holes due to automatic fiducial registration and online scaling

LPKF MicroLine UV Systems

- Frequency-tripled Nd:YAG-laser operating at 355 nm wavelength for the production of ultra-fine structures
- Substrate dimensions up to 18“ x 24“
- Scanner system for highest structuring speeds
- Telecentric optics for vertical edges
- High-precision, highly dynamic x-y table
- Automatic substrate handling
- Automatic alignment: camera-based vision system for fiducial identification and online scaling
- Automatic system calibration
- Input data formats: Gerber, HP-GL™, Excellon, DXF, etc.
- Debris extraction during processing

RO 4003®: Tin-resist-technology and through-hole



Cut through RO 4003®, thickness 0.8 mm

200 µm through-holes in RO 4003® before plating

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