APP NOTE # 22 – 20210809

AUGUST 21

# PRECISION POLYMER CUTTING WITH ORIGAMI-03XP FEMTO UV LASER

**Polymers are widely used in manufacturing for applications such as circuit boards, medical devices, OLED display technology, etc. Traditional mechanical processes tend to result in low yields and frequent retooling.**

Laser processing of polymers is well-established. But, for markets that demand higher precision and quality or for thermally sensitive materials, a move to shorter wavelengths has gained wide acceptance in several industries. With the advantage of focussing to much smaller spot sizes than its longer wavelength rivals, a UV laser allows for material removal on much smaller scales over a wide range of materials. Furthermore, UV lasers are readily absorbed by most organic materials.

Combined with its shallow absorption depth, it is possible to precisely machine very small volumes with virtually negligible heat affected zones. Thin polymer films can be cut into complex shapes or drilled with exceptional resolution for applications within flexible circuit boards and OLED display technology.

Small kerf widths allow for higher precision and resolution whilst delivering much less thermal input to the bulk of the material, resulting in excellent quality cuts. Furthermore, the shorter wavelengths deliver longer Rayleigh lengths which give a bigger depth of focus for improved processing tolerances and can be utilized effectively when cutting non-flat samples, such as tubes.

**In our applications lab, we have demonstrated the cutting of the following polymer films using our ORIGAMI-03XP UV femtosecond laser:**

- PET
- PTFE
- COC
- Polycarbonate

Figure 1. Kapton foil (25 µm thick) cut with ORIGAMI-03XP 343 nm laser.

Kapton (polyimide) is well-known for its ability to retain its mechanical, electrical, and thermal properties under harsh conditions as well as its chemical inertness and is widely used in flexible circuits. The ORIGAMI-03XP UV laser cuts these films with exceptional cut quality.

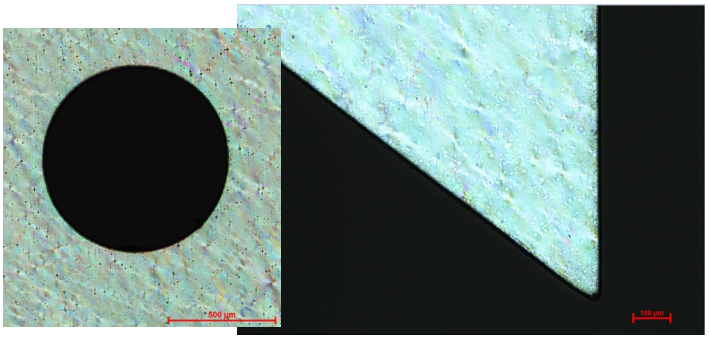


Figure 2. PET cut with ORIGAMI-03XP 343 nm laser.

Polyethylene terephthalate (PET) film is a clear, strong, and lightweight material. It is becoming a popular substrate in the consumer electronics industry for manufacturing flexible microelectronics circuits and displays due to its transparency, high tensile strength, thermal stability, electrical insulation, and chemical resistance properties.

PET is often used in OLED display manufacturing and frequently stacked with other materials. The 75 µm thick sample is transparent, but this is no problem for the ORIGAMI-03XP laser.

PET is prone to thermal damage, so the ORIGAMI-03XP UV laser provides a solution that cuts these films with minimal heat leading to excellent cut quality and high precision.

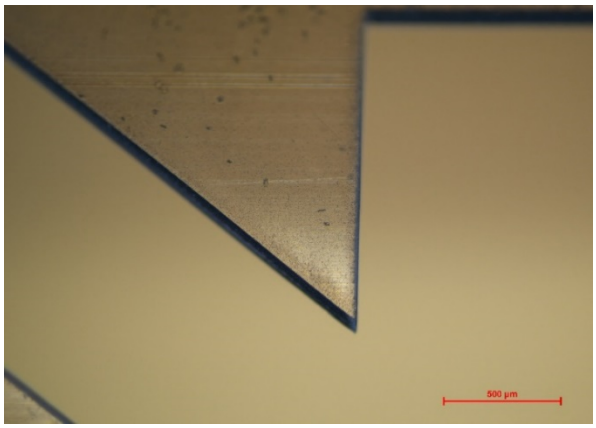



Figure 3. PTFE 150 µm thick cut using the ORIGAMI-03XP laser.

PTFE has good electric insulation properties and is used to insulate cables and connector assemblies. Combined with its chemical inertness and low refractive index, it is ideal for the microelectronics industries exhibiting displays and flexible printed circuit boards.

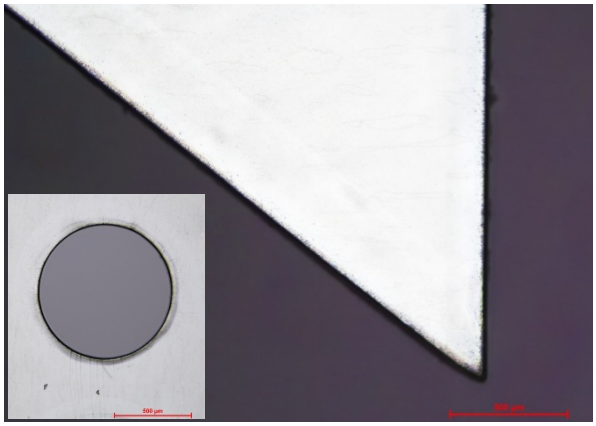


Figure 4. COC 100 µm thick cut with high precision and good quality using the ORIGAMI-03XP UV laser.

Co polymers/COC are low-cost polymers with a high optical transparency, chemical resistance, and bio-compatibility. It is a glass-clear and extremely pure plastic for healthcare, optics, packaging, and electronics applications.

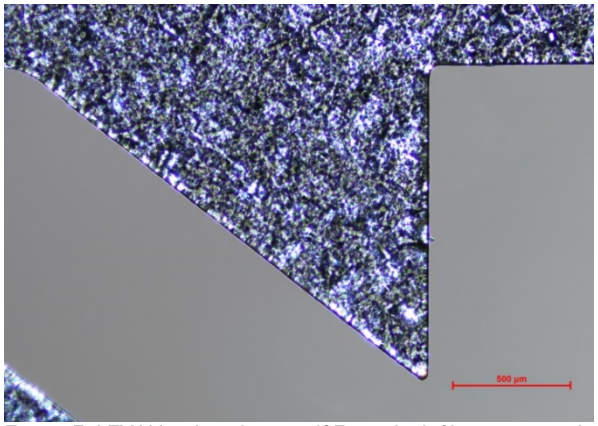


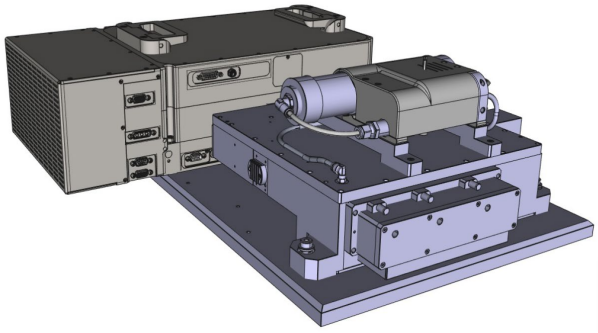

Figure 5. LEXAN polycarbonate 125 µm thick film cut using the ORIGAMI-03XP UV laser.

Polycarbonate films are well known to offer good optical clarity, very high impact strength, and offer resistance against high temperatures for distortion.

## Summary

The ultrashort pulses delivered by the ORIGAMI-03XP UV laser are very well suited for processing thermally sensitive polymer films which are often used in display or electronics. The low HAZ and small spot size afforded by the ORIGAMI-03XP ensure precision machining with high quality.

## ONEFIVE ORIGAMI 03XP



**The ORIGAMI-03XP is a UV femtosecond laser, allowing computer-controlled, flexible switching between IR, green, or UV wavelengths in one laser system.**

Based on the highly successful ORIGAMI XP platform, the same advantages of clean, femtosecond pulse output, excellent beam quality together with unprecedented beam stability are obtained as a result of the Optocage™ laser design.

- Air-cooled, single-box for ease of integration
- < 400 fs standard pulsewidth
- 5W / 70 µJ @ 1030 nm
- 2.5W / 35 µJ @ 515 nm
- 1W / 17.5 µJ @ 343 nm
- Single-shot and Pulse-on-Demand
- Dual-output wavelength module
- Outstanding energy and pointing stability
- Industrial, rugged design
- Mountable in any direction
- Real-time pulse energy measurement and control
- Unprecedented reliability
- Water cooling available