Glass Cutting with UV Lasers

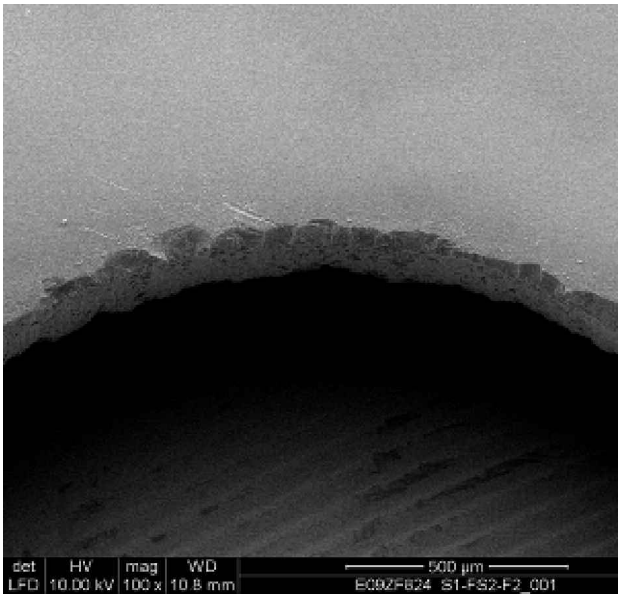
Laser glass processing is increasingly utilized as various consumer electronics, such as televisions, mobile/smart phones, and GPS devices gain in popularity. Motivating factors include reduced cost through increased yield and device enhancement through laser-enabled processes.

Lasers are used to process differing glass types, ranging from low-cost soda lime glass to a variety of higher-quality borosilicate glasses. Cutting requirements include basic straight line cutting/singulation as well as simple and complex geometric shapes. Process challenges include throughput, reduction of melt, and prevention of microcrack formation.

Using high-speed, multi-pass processing with a scanning galvanometer, 355 nm Q-switched laser (Pulseo®) pulses were focused to <10 μm spot size to create the high intensities required for glass machining. The small spot size coupled with high-speed beam scanning work to minimize heat accumulation, thus reducing the thermal loading of the glass. Also critical for minimizing or reducing heating and microcrack formation is the short pulse duration of the Pulseo laser system.

2-mm diameter holes cut in 1-mm thick soda lime glass

Material	Thickness	Laser, λ	Speed
Soda Lime Glass	1 mm	Pulseo 355 nm	2 mm hole in 6 sec
Borosilicate Glass	200 μm	Pulseo 355 nm	20 mm/sec cut speed



SEM image showing laser-cut rounded corner in 200-μm thick borosilicate glass

Spectra-Physics' Industrial Applications Lab has developed processes for cutting 1-mm thick soda lime glass and 200- and 100-μm thick Schott D-263 borosilicate glass. A high-speed trepan-cutting process cuts 2-mm diameter holes in the 1-mm thick glass in less than six seconds. For the thinner borosilicate glass, straight and curved lines are cut at 20-mm/sec average speed.

SEM imaging indicates high quality cutting with no visible microcracks in the 200-μm thick Schott D-263 borosilicate glass. And visual inspection of the large-diameter holes in 1-mm thick soda lime glass shows minimal sidewall taper and clean overall appearance.

Spectra-Physics®
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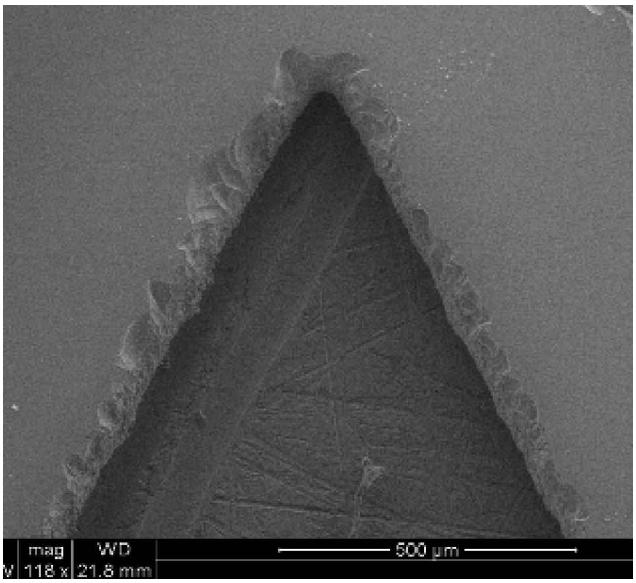
Material	Thickness	Laser, λ	Speed
Borosilicate Glass	100 μm	Pulseo 355 nm	37.5 mm/sec cut speed



SEM image showing sharp, HAZ-free corners cut in 100-μm thick borosilicate glass

For 100 μm thick D-263 glass, speeds approaching 40 mm/sec are achieved. With the thinner glass, very sharp corners are possible without microcrack formation when using short-pulse laser processing.

For a variety of glass types and glass thickness, Spectra-Physics' short-pulse Q-switched lasers offer superior results. Depending on thickness and throughput requirements, a variety of Spectra-Physics 355 nm Q-switched product families may meet your demands, including Explorer®, HIPPO™, Navigator™, and Pulseo lasers.

Product: Pulseo

Spectra-Physics Pulseo® 355-20 laser is our highest-power UV Q-switched laser. With >200 μJ pulses delivered 100,000 times a second, high-throughput performance is achieved; and at <23 ns pulse duration, high quality machining is realized – this is the benefit of high-peak power.

Model	Wavelength	Peak Power	Average Power	Pulse Width	Repetition Rate (nominal)
Pulseo 355-20	355 nm	~10 kW	>20 W	<23 ns at 100 kHz	100 kHz
Pulseo 355-10	355 nm	~5 kW	>10 W	<23 ns at 90 kHz	90 kHz

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