

New development of continuous cast laser processing technique

PLASTICS
FABRICATION

by Lucite International

Two industry leaders in innovation, Lucite International and Universal Laser Systems met last year at the IAPD Annual Convention in Las Vegas, leading to a collaboration between the two companies that resulted in a specific new laser processing technique for cutting and engraving a specific line of Lucite's continuous cast acrylic sheet products.

"From the initial design and styling of our sheet products, to the processes used for fabrication and to the final sale of the end product, Lucite is always looking for new and innovative ways to build upon the high standard of quality and function that define our brand," said Chris Robinson, sheet business manager for Lucite. This laser technique has now been added to Lucite's fabrication guide, included here and also available on its web site.

General information

CO₂ laser systems provide an ideal, non-contact method for cutting and engraving of acrylic sheet. Both processes can be combined into a single manufacturing step, and run without the need for tool cleaning or sharpening and without cutting fluids or polishing compounds.



Figure 1. Raster engraving, vector engraving and cutting LuciteLux™ sheet in a single laser processing operation.

The 10.6 micron wavelength emitted from the CO₂ laser is absorbed very efficiently by polymeric materials such as continuous cast acrylic. The absorbed laser light is converted to heat, and the heat causes material that is directly in the laser's path to vaporize (ablation). Higher laser power densities can be used to cut through continuous cast acrylic sheets leaving a clean, square and polished edge. Lower laser power densities can be used to engrave a high definition, permanent mark into the surface of the material for branding or serializing parts. See Figure 1 which shows a sheet of continuous cast acrylic that was cut and engraved using a CO₂ laser in a single, continuous operation.

Laser cutting

A 2.0 lens (two inch focal length) is suitable for most cutting applications. Air assist with back sweep is recommended for cuts of greater than 0.250". The back sweep will allow direction of the high pressure air across the surface of the work piece instead of down the cut where it could cause frosting of the cut edge. Gas assist with nitrogen is recommended for thicknesses greater than 0.500". For gas assist, a cone will provide better direction of the low pressure nitrogen to the cut. Since the nitrogen pressure is low, frosting of the edge due to rapid cooling is not an issue. Also, for thicknesses greater than 0.500", switching to a 3.0 lens will provide a more uniform cut through the thickness of the work piece due to reduced beam divergence.

When cutting, it is best to remove the masking from the top side of the work piece so that it will not interfere with the laser cut. Leave the masking on the bottom side of the work piece to protect it from reflections off the cutting table. For applications where edge quality is critical, the work piece should be elevated about an inch above the cutting table to avoid all reflections.

For cutting, the laser is usually run at 100 percent of its rated power. Lower cut

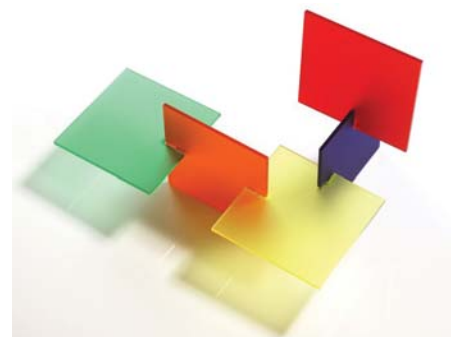


This precision cut LuciteLux™ lamp designed by Nahoko was made using Sapphire Blue from Lucite's "Hot Range."

speeds are used for thicker materials. Figure 2 provides guidance on laser power selection and laser cutting speed respectively.

Laser engraving

Laser engraving can be done in raster mode as well as vector mode as demonstrated in Figure 1. In each case, the engraving depth is a function of the laser power density. Figure 3 provides informa-



These precision linked LuciteLux™ acrylic samples include the Emerald Green, Chili Red, Sapphire Blue and Mandarin Orange from Lucite's "Hot Range," as well as Saffron Yellow from Lucite's "Vivid Range."

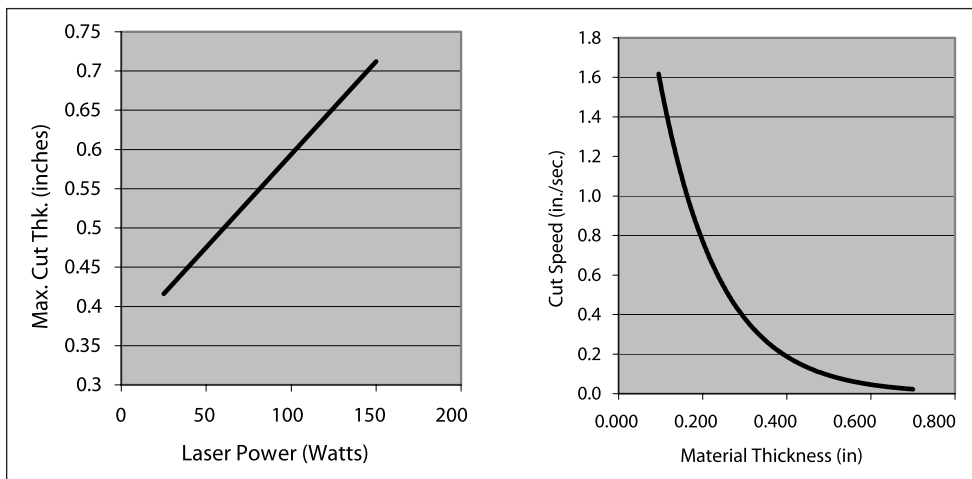


Figure 2. Maximum thickness that can be cut as a function of laser power (left), and maximum cut speed as a function of material thickness (right).

tion on raster engraving depth and vector engraving depth as a function of laser power at constant engraving speed.

A 2.0 lens (two inch focal length) is suitable for most laser engraving applications. For applications that require very fine detail, high power density focusing optics (HPDFO) are recommended. This will provide a much smaller laser spot size than the 2.0 lens.

For most applications, the masking should be removed from the top side of the work piece. The top side masking should be left in place for deep raster engraving (depths of greater than 0.010") in order to avoid hazing of adjacent surfaces due to redeposition of ablated material. Leave the masking on the bottom side of the work piece to protect it from mechanical damage (scratches).

High volume manufacturing

For cutting operations, increasing the laser power will improve the throughput of the laser system. A dual laser system allows the beams from two lasers to be combined into a single beam, thus providing the maximum cutting power. Universal

Laser Systems offers a unique configuration that combines the two beams in a complimentary manner for superior cutting uniformity. For engraving, the two beams can be operated in parallel so that two identical parts can be processed simultaneously.

Caution

Acrylic materials are flammable. Laser systems should not be left unattended when processing any acrylic material.

Conclusion

Continuous cast acrylic sheet is easy to cut, join, form and fabricate. And now with this new laser technique for cutting and engraving continuous cast acrylic sheet, the design options are endless. ■

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For information on Universal Laser Systems, contact Joe Hillman, manager, Advance Materials Processing Center, (480) 483-1214, ext. 247, e-mail: jhillman@ulsinc.com.

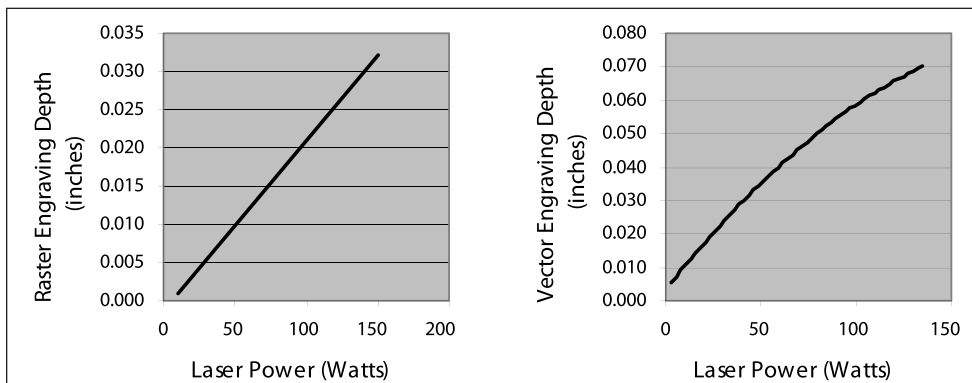


Figure 3. Raster engraving depth as a function of laser power (left), and vector engraving depth as a function of laser power (right).

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