Laser Label Cutting

Ensuring Maximum Throughput

SYNRAD
A Novanta Company

The digital printing revolution has significantly changed the landscape of label design and creation. The flexibility inherent to digital printing has increased demand for shorter runs and unique label design. This presents a challenge for label makers.

Lost production time for change-overs and costs to maintain an ever-increasing number of traditional die patterns drive operating costs higher, and reduce profitability. Laser cutting with high-speed scan heads can change this to a dynamic, flexible process where cut design changes can be performed on-the-fly without stopping the production line.

Most plastic and paper labels can be cut with a CO_2 laser; these materials absorb the long wavelength characteristic of these lasers very well. The exception is vinyl-based labels, which typically char and can create hazardous out-gassing.

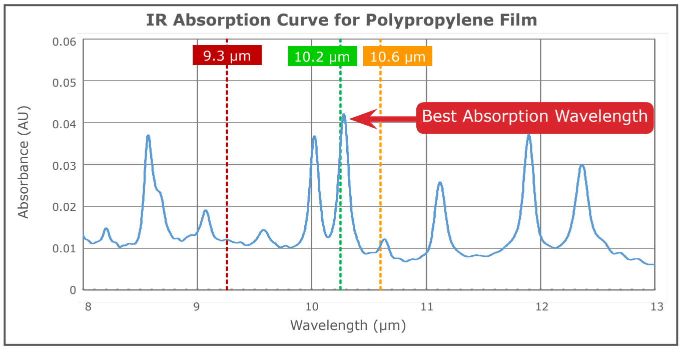

Figure 1: Polypropylene absorption curve

To achieve optimal laser cutting quality and speed, it is necessary to understand the unique absorption characteristics of a given label material. Label sheets involve multiple layers of material, including a base or backing material, an adhesive-coated plastic or paper label, and a protective top coating. While each of these layers must be considered when selecting the appropriate laser, the top-most layer receives energy first and therefore its absorption characteristics will dominate. For example, a polypropylene label typically has higher absorption in the 10.2 – 10.3 µm range than at the standard 10.6 µm wavelength most common in CO_2 lasers. Just by optimizing to the 10.2 µm wavelength, improvements to cut quality and throughput compared to the same laser power at 10.6 µm become apparent.

Example Test Case Setup

To test this claim of wavelength optimization, a subsystem was assembled—first at 10.6 µm and then at 10.2 µm. In both cases, a Synrad p250 laser was combined with a Flyer 3D scan head. Scanning heads are preferred for label cutting due to their high speed galvo mirrors, which are capable of directing the laser beam across the material much more quickly than X-Y plotters. Three-axis scan heads are most common for applications requiring a small spot size over a large field of view—necessary to achieve quality, detailed cuts across a sheet of labels.

The Flyer 3D was configured with a field size measuring 400 mm x 350 mm (15.74" x 13.77") and a 282 µm (0.011") focused spot size. The p250 laser was chosen due to its excellent power stability, providing consistent label cut depth even over long production runs.

Figure 2: Synrad adhesive polypropylene labels

Results

The sample material was a sheet of 0.1 mm (0.004") thick polypropylene Synrad labels. The p250 laser was run at a duty cycle of 45% at 50 kHz PWM. This high repetition rate causes the laser pulses to merge, resulting in a continuous cut of the material. The measured average laser power was 275 W at the material surface. The standard 10.6 µm p250 cut labels at 4064 mm/s (160 ips), while the 10.2 µm p250 cut at 6096 mm/s (240 ips) – a 1.5X improvement! In addition, the 10.2 µm wavelength was so efficiently absorbed by the labels that there was only negligible scoring of the backing material. The labels peeled easily from their backing sheet and had smooth edges with minimal melt (Figure 2).

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