Fiber Optic Laser Engraving for Anilox Rolls

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Anilox engraving technology has seen many advances in recent years. If you are someone who gets involved in this area of the flexo industry, you are no doubt familiar with the increasingly confusing engraving charts that anilox suppliers are offering as their menu of engravings. Of course, each of us suppliers must complicate the industry even further by having our own individual trade names for each of these capabilities. To be an educated purchaser of anilox rolls these days, you must be familiar with acronyms like CO2, YAG, BCM, and NAT, and phrases like multi-hit, superfinishing and depth-to-opening ratios. Although specifying engravings has become increasingly difficult due to the increasing number of options, I don't think anyone would deny that the value added, and the increased versatility of today's anilox suppliers, has advanced our industry as a result.

As we all know, becoming educated and staying abreast of the latest technologies has certain benefits. In the past year, yet another advancement in laser engraving technology has made itself available to the flexographic community. This new technology advances the realm of high line screen engraving by using diode pumped fiber optic lasers. Until recently, high line screen engravings could only be produced by using YAG (Yttrium Aluminum Garnet) lasers.

Higher line screens

Engravings produced by YAG lasers have been embraced by many because of the high line screens and high volumes available compared to CO2 laser capabilities. CO2 capabilities begin to strain at around 900 LPI (Lines Per Inch, or Lines-screen), and generally end at 1200 LPI. Volumes (BCM or Billion Cubic Microns) are also relatively limited compared to YAG engravings. YAG lasers, on the other hand, are capable of engraving up to and above 2000 LPI and with plenty of volume. In fact, YAG engravings can be engraved so deep, that it usually does not make sense to engrave to the maximum volume attainable. Research shows that solid ink densities continue to rise well into the 50% to 60% range. Beyond this range it typically makes no sense to engrave any deeper.

It is no secret that there is a negative correlation between line screen and dot gain. Higher line screen rolls increase ink control and reduce dot gain. These high line screens have done much to increase flexo's competitiveness with offset and gravure. Where 133 line-screen plates were recently considered high, now 200 line-screen and above are becoming more common. To print these high line screen plates and low percentage dots, high line screen anilox rolls are required. As a rule of thumb, the ratio between plate screen and anilox screen should be about 5:1 to 6:1. For example, this means is that 1000 LPI anilox rolls are at the low end of the requirement for 200 line screen plates. In fact 1400 LPI to 1600 LPI anilox rolls have become very common. Until recently, only YAG lasers were able to fill this need in the market.

Although YAG lasers have the capability to produce these high line screen anilox rolls, the cell structure that YAG lasers produce is significantly different than cells created by CO2 lasers. Generally, YAG engravings are viewed to be more fragile and susceptible to scoring and damage than CO2 engravings.

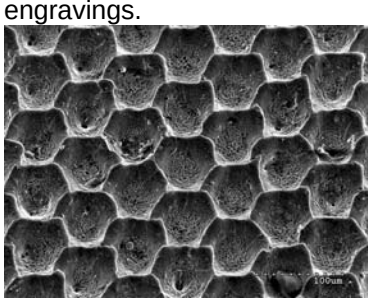

Figure 1 CO2 engraving

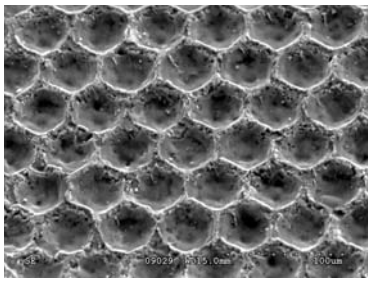

Figure 2 YAG engraving

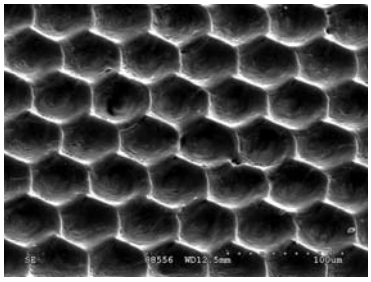

Figure 3 Fiber optic laser engraving

YAG engravings tend to have poor release characteristics as well, sometimes leading to premature plugging. New fiber optic laser engraving technology has the ability to produce high line screen engravings, but without the undesirable cell characteristics of the YAG lasers.

YAG vs. CO2 lasers

For this article it is helpful to know why differences in engraving capabilities and cell characteristics exist between different types of lasers. First lets talk about line screen capabilities between YAG and CO2 lasers.

The reason for the differences in line-screen engraving capabilities lies in the relative wavelength of the two lasers. Laser energy is transmitted by waves. Lenses are used to capture and focus this energy onto a specific point on the surface of the anilox roll. One pulse of this energy will create one cell. The lower the wavelength, the tighter the focus, therefore smaller cells are attainable with lower wavelength lasers. YAG lasers have 1/10th the wavelength of CO2, and therefore is able to focus on a much smaller point. A good analogy would be to compare creating a hole with a shotgun (CO2) and one with a rifle (YAG). The shotgun will of course create a hole, but it cannot focus its force as directly as a rifle.

Another major difference between YAG and CO2 lasers, and one that is not too often referred to, is the cell structure generated by both. CO2 lasers incorporate a high thermal component to engrave cells into an anilox roll. What this means is that the CO2 laser burns and melts the ceramic, creating and forming cells like a hot poker in butter. YAG lasers, on the other hand, tend to evaporate the ceramic, creating cells by removing ceramic. The distinction between these two methods is important and has a large effect on cell durability and the texture of the cell inner lining.

CO2 lasers create cells with inner cell linings and cell walls that are relatively smooth, less porous, and more durable compared to cells created by YAG lasers. Figure 1 is a picture of a CO2 engraving, and Figure 2 is a picture of a YAG engraving. Both of these pictures were taken by a Scanning Electron Microscope or SEM. These SEM photos offer a unique look at anilox cells because the depth of view allow us to see the entire cell structure at once instead of focusing on just one area like the tops of the cells or the bottom of the cells.

By visual comparison you can see that the YAG cell walls are wider and more porous than the CO2 cell walls. This is because the thermal component of the CO2 laser has burned and fused the cells together. It is this fusion process that creates durable cell walls and cauterizes what porosity may be present in the applied ceramic. The YAG engraving does not have the benefit of this thermal component and therefore tends to leave weaker cell walls and rougher cell inner linings.

I think most would agree that, although the high line screen capabilities of the YAG lasers have real benefit and value, and have advanced the world of high quality process printing, the cell structures of the engraving lack durability and ink release.

Fiber optic lasers

New technology has been developed over the past two years that offers the flexo industry high line-screen anilox rolls with durable cell structures and excellent ink release characteristics. Fiber Optic lasers have a wavelength similar to the YAG lasers. Since it has a low wavelength, it is able to engrave high line screens up to and above 2000 LPI. The fiber optic laser also engraves cells with a high thermal component, much like CO2 lasers, and therefore creates a vitrified, almost glasslike cell inner lining. As you can see in Figure 3, the cells created by the fiber optic laser are extremely smooth with a solid structure. The result is a high quality, high line screen, durable cell structure that has great release characteristics.

In the past year Stork has produced hundreds of fiber optic laser engraved anilox rolls that are now in the market

and the results arte very positive. Reports indicate an average of 10% to 15% better ink release than YAG engravings of the same line-screen and volume. When line-screens of 1200 LPI to 1800 LPI and beyond are being used, it is doubly important to have excellent ink release characteristics. A 1500 LPI cell will have a cell diameter of only 14-16 microns and therefore will require diligence to maintain no matter what the surface characteristics. The fiber optic engravings make the cleaning and maintenance of these specialty rolls much easier and quicker and also reduce plugging on press during long runs.

Another benefit of this new engraving technology is that it is very consistent and easy to maintain. The fiber optic laser does not consume gasses like a conventional CO2 laser, nor does it use a lamp like the YAG lasers. Instead, the fiber optic lasers use a solid-state media to generate the laser. Where Co2 and YAG lasers tend to require diligent maintenance in order to produce consistent cell structures and volumes, the fiber optic lasers are much less labor intense. The ultimate result is lower costs and better consistency.

The introduction of the laser engraved ceramic anilox roll back in the late 1970s marked a huge leap forward for the entire flexographic industry. Since then many advances have been made to improve the quality, consistency and durability of the product. This latest advance is unique in that it improves all three.

In my opinion, the innovation that has had the most impact recently was the development of the YAG engraving technology and that was almost eight years ago. YAG engraving technology opened up a whole new world for those specializing in process printing. High line screen anilox rolls are a must for the high line screen plates being printed today. Thankfully we now have an alternative to YAG.

Most new technologies take some time for the market to adopt. I don't suspect fiber optic engraving of anilox rolls will take very long to become widely known and accepted. Put very simply, this is better technology, that produces a better product, more consistently, and cost effectively. Of course, as we anilox suppliers are want to do, we will all have our different trade names and special spin, but be assured this technology is worthy of your interest and investigation whatever it is called.

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