

A Substrate Guide To Laser Etching

Laser etching yields which fabrics and materials yield the best results.

Maximizing the opportunities presented by laser etching requires an understanding both of how the process works and its effects on specific substrates. The advantages of the process, including its unique look, cost efficiency, and speed, have been proven in decorating applications from apparel to wood; but applying it successfully in a given situation calls for some R&D and experimentation. The time and energy you invest, however, can pay big dividends now and down the road as you grow your capabilities and your business.

First off, it's important to understand the way laser etching works. What you're basically doing is using a laser light that concentrates a high level of heat in a microscopic point to burn away a portion of the substrate, melting and restructuring but not destroying the top layer to create dimensionality.

As Henry Bernstein, president, Three Driveway Media, Solon, Ohio, a marketing and consulting company specializing in the decorated apparel industry explains, "You're using the laser to draw. In the case of fabrics, you are reconstructing the fibers just enough to create a visible image by making the structure seem thicker."



Synthetic suede is an ideal substrate for laser etching because it is the most tolerant. You can use the widest range of settings to get different looks. Photo by Henry Bernstein, courtesy of BI/TO, Deer Park, NY. Sample courtesy of Imagine Images, Modesto, Calif.

"With most fabrics, the fibers also seem darker because they have been concentrated, creating a wider area over which less light is reflected. On hard goods, the heat may alter the finish of the surface; for instance, it may create glossiness by fusing substrate particles.

"Dynamics such as these are key reasons the process can produce the distinctively subtle images it is known for. And designing with their effects in mind not only ensures success but also extends the creative possibilities."

Which Lasers Etch?

The etching process on textiles and fabrics is best performed using a galvanometric laser, which has a less-damaging beam than its counterpart, which is a conventional plotter type laser.

A galvanometric laser sprays its beam like mist vs. a plotter, which shoots it out like a fire hose with high concentration. Galvanometric lasers are typically available as a standalone or a laser bridge, which is erected over multthead embroidery machines or over multiple tables that can be used as separate engraving stations. Plotters are typically standalone machines or attached to an embroidery machine.

All embroidery singlehead lasers available at the time of this article are made with a plotter-type laser, which is singular beam. Plotter lasers are not suitable for etching. However, there is at least one manufacturer who is developing an integrated singlehead plotter laser that will be able to do etching. That machine is expected to become available sometime in 2016.

In addition to requiring a galvanometric laser to do etching, you also need a certain minimum amount of power. The recommended amount is 50 watts for etching fabrics and leather.

The value of getting a laser with higher wattage that is more expensive is it will also cut faster. So a 100-watt laser will cut twice as fast as a 50-watt laser. The 50-watt laser is fast, but in some high-volume shops, the greater speed of a 100-watt may be worth the cost.

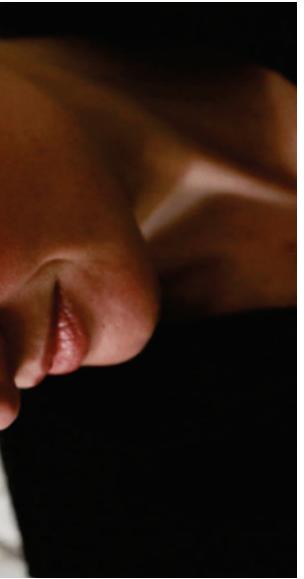
The variety and size of lines and exposures are the primary tools for creating laser-etched designs. "The vector, or the line to be etched, is created in the design software," says Bernstein. "What the laser settings control is the angle and thickness of the line. These are set as percentages. Whether or not you use an angle depends on the grain of the fabric.

"You have to be careful how you place the vector lines when designing

because you don't want them crossing over each other and causing an area to be exposed multiple times. Crossover will create a hole. So where a design has an acute angle, like an arrow, you need to round it off."

Power Play

"The key variables to control on the machine are the energy or power coming out of the laser and how fast you want that power to move," Bernstein continues. "And these variables are interrelated."



You can etch on natural leather but it is more difficult to get consistent results. This is due to natural leather being less uniform in its thickness. In this example, the leather is synthetic. Photo by Henry Bernstein, courtesy of BITO, Deer Park, NY. Sample courtesy of Imagine Images, Modesto, Calif.

"Height is crucial to ensuring that the material being etched is the focal point of the laser," says Bernstein. "The laser is like a point. You want the absolute sharpest part of the point—where there is the greatest amount of laser exposure—to hit the heart of the design."

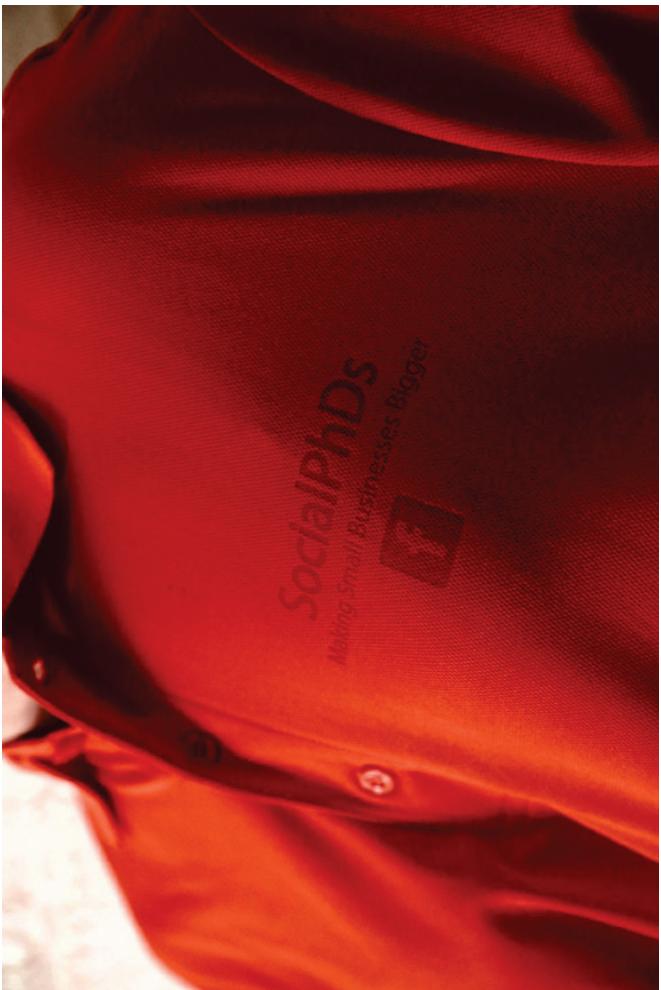
If your laser's midpoint is 50% of power, you may have to go to 70% to create the design properly or go down to 30% because 50% is too strong," says Bernstein. "The laser strength is determined by the application. So you have to adjust the laser based

on the thickness of the material."

"Performance fabric might be 8%, while polar fleece might be 15-20%," he continues. "You have to compensate with the laser in order for the focal point to be in the specific area you want the etching to occur."

The speed of the laser also is a primary consideration. Time, speed, and energy are the key factors in exposure. A slower speed means longer exposure. If you have a higher concentration of light, you may have to increase the speed to avoid burning the substrate, or you might lower the concentration to align it with the slower speed.

You also can vary the number of passes across the design or portions of it to achieve different looks. There are a variety of controls to experiment with. The manufacturer will guide you through the basics of laser exposure; but you have to play with the variables to see what produces the best results.



Power is synonymous with the concentration of light. Laser etching requires less power than laser cutting, but the larger the work area, the greater the power that's required to use it.

If your work area is large, like for a pair of jeans, then your laser projection needs to be higher than for something small like a pocket. The higher the laser, the further away it is from the substrate, the greater amount of power is needed.

"Laser etching has become the friendliest decorating process for performance shirts because it does not interfere with the fabric's breathability or moisture wicking properties. Photo by Henry Bernstein, courtesy of BITO, Deer Park, NY. Sample courtesy of Imagine Images, Modesto, Calif.

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To etch large items or long items, like a pair of jeans, the product is etched in segments and then repositioned. This process can be aided with the use of an accessory such as a shuttle bed that can be moved after each segment is etched, eliminating the need to move the actual garments. Photo: Henry Bernstein, courtesy of BTTO, Deer Park, NY

Compared to a process like screen printing, laser etching is relatively new to the decorated apparel industry. What this means is that there are still discoveries to be made. While general guidelines and proven results are known for some substrates, shops continue to test new fabrics at different settings all the time.

Natural fibers and hides, which include leather, silk, wool, and cotton all, respectively,

Synthetics Etch The Easiest

At the heart of any laser etching scenario is the substrate. Although testing is critical to success in any application, there are general things to keep in mind with respect to various types of substrates.

When it comes to apparel, synthetics are typically process-friendly, while natural fibers tend to be more difficult to work with, Bernstein notes. "With manufactured fibers, you have a definitive consistency that allows for repeatability," he explains. "These are extruded fibers with a specific physical size; so when you combine them, you have a construction that is uniform."

For some types of apparel, etching is the friendliest decoration method. If the material is heavy enough, it allows for the possibility of large designs without the hand and bulk of other decorating techniques, like screen printing or embroidery. It also allows for a greater range of placements and effects on a garment.

Laser Etching Favorites

Denim. This fabric can be a particularly good one for laser etching. The burning out of the indigo dyes during the process creates interesting effects. Although it's important not to burn too quickly to guard against overexposure, denim has a surprisingly strong tolerance for heat.

scorch when cut with a laser due to their natural tendency to burn, with leather being the most to show burn marks, cotton being the least and silk and wool in between. However, high-quality lasers with a finer laser beam spot and higher power output can reduce scorching, and in some cases eliminate it completely.

Techniques used to control scorching include advanced control settings over time and speed as well as mechanical enhancements such air assist. By using a line that allows air or other gases to flow through, it's possible to cool down the area being cut during the cutting process. The air assist works by blowing air over the area where the laser is passing. This reduces smoke and reduces burn marks.

So although natural fibers present more challenges, there are ways to help eliminate the scorching. That being said, here is a rundown of some of the most popular fabrics being etched at this time.

Performance wear. The fact that it can be used to embellish performance fabrics without impacting characteristics like moisture-wicking, hand, flexibility, and breathability, makes this a category with a lot of potential. Because the process embellishes the fabric without covering the fibers, it allows the material to do the things it was designed to do.

This is an additional plus, according to Bernstein, "because while you can get away with anything that you can stick on for a small logo, once you have a larger decorating area, it can detract from the characteristics that sell performance wear."

The primary consideration here is the specific performance fabric. You have to know how heat-sensitive the material is—how much heat it can withstand and also how quickly it will "draw," or shrink. Nylon shrinks faster than polyester, for example. If it's a thin material, the laser will have to move faster. The quality of the fabric also can factor into its response to heat.

The fabric and its color also can affect the way the design is approached. Performance fabrics darken when they are laser etched. And in general, black and white performance fabrics do not etch well, because it is hard to achieve sufficient visual difference. Typically, the process tends to be more effective on lighter colors, with the exception of white.

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Laser etching also can be used to create patterns like whiskers on jeans from the crotch to hip that mimic fabric folds as well as distressed looks in spots where there is heavy wear. It amplifies denim's natural feel and offers a faster, less-expensive alternative to prewashing, sanding, and other distressing techniques.

Denim lightens when it is etched. The effect can fade with washing, so it may be necessary to hit the stripe harder if the client sees this as a negative. But typically, this adds to overall look.

Cotton Twill. This is another good candidate for laser etching, and it performs in a similar fashion as denim. A lot of the same effects can be achieved, but you have a wider range of colors available than traditional denim. If you are going for a distressed look, cotton twill also frays nicely, allowing you to do etching and distressing with the same piece of equipment.

Athletic (Poly) Twill. Since this material tends to be quite shiny and similar in look, etching with laser will show a flat effect of tone on tone color. Users tend to use a repeat of a small pattern in a motif-like manner to brand their logo onto the item.



When laser etching on polyester fleece, the laser darkens the area and lowers the loft creating a unique dimensional look. Not all colors laser etch well so be sure to test colors in advance. Photo courtesy of Charles River Apparel, Sharon, Mass.

Fleece. Here, there are several factors to consider. One is fabric composition. If it is a poly-cotton blend, the polyester fibers are the ones that will change, while the cotton will burn away. High-cotton fleece is tricky. (See the section on cotton below.)

In the case of polyester fleece, loft affects the look. This is a synthetic material that is combed to create pile so it has a fibrous, spongy feel. Laser etching melts the tops of the fibers causing them to sink and creating a darker area that makes the design visible.

Etching poly fleece is quick and easy, and the effect is smooth and soft and doesn't require a backing. The thing to watch out for is color, which can be problematic on very light or very dark shades.

Synthetic suede and chamois. These lend themselves well to laser etching, whether it's a patch or finished garment. It is one of the most tolerant fabrics that allow a wide range of power settings to be used for creating a variety of different looks. Use less power to create thin lines, or more power to create thicker lines, or less power to create a light contrasting look, or more power to create a darker area.

Cotton T-Shirts. They can be done; but proceed with caution. Because it's a natural fabric, cotton yarn thickness is inconsistent, which makes it difficult to maintain uniform control. When a laser hits a heavier spot, it's easy to char the dye and burn partially or all the way through the fabric. In addition, although you may get cool initial results, the design will fade with washing, leaving a hard-to-see ghost effect.

Natural and Synthetic Leather. There also are consistency issues with leather. This is particularly true with natural leather, where it's difficult to achieve repeatable results on different skins. Even synthetic leathers may not always react the same way, although there will be consistency within a given lot. The key is to test in advance so there are no surprises during production.

Etching is like a new frontier in decorating apparel. The possibilities are endless and what has been done has just scratched the surface. If you've purchased a laser for speeding up applique production, it is well worth the time to do some research and development to see what additional services you can offer your customers using etching.

Ed Balady is president of BI TO USA, Deer Park, NY, a distributor of the Proel/line of embroidery and standalone lasers as well as Millennium digitizing software. He also is co-owner of Proel TSI, the manufacturer of the Proel/line. He has been in the industry since 1985 selling embroidery machines and related equipment. To reach Balady, you can email him at ebalady@bitousa.com or visit the website at www.bitousa.com.