

Just What is Laser Engraving

Laser engraving is the process of using a laser to alter the material it's focused on. Even before lasers were mainstream as kids we would use a magnifying glass and the sun's rays to mark and burn paper. So really we've been using light to burn things for a very long time. In the case of lasers it's become a much more refined process.

First let me describe the components and different types of lasers systems. In a laser system there are three main components that make up the system.

1. The active laser which can be of the gas, crystal or glass fiber variety. Depending on what variety of laser is being used it will be targeted towards specific materials or uses.
 - a. The most common gas laser is CO₂ (10.6 μ m λ) which is used for marking on most materials other than metals.
 - b. The crystal laser is the YAG (yttrium aluminium garnet, 1.064 μ m λ) which is suited well for marking on metals.
 - c. Glass fiber lasers are fiber optics that are doped with rare-earth elements usually yttrium (also 1.064 μ m λ) and these are also suited well for marking metals.
2. A pump, the purpose of which is to transfer energy from an external source and "pump" it into the laser medium. When the pump exceeds the static state of the laser medium the output will be the laser energy.
3. The third component of a laser system is the resonator. The resonator is made up of mirrors which when aligned properly create standing waves for certain frequencies which are determined by the laser medium. The pattern produced by these standing waves are called modes. With the employment of a one-way mirror the output not reflected will be the laser radiation or what we think of as the "laser."

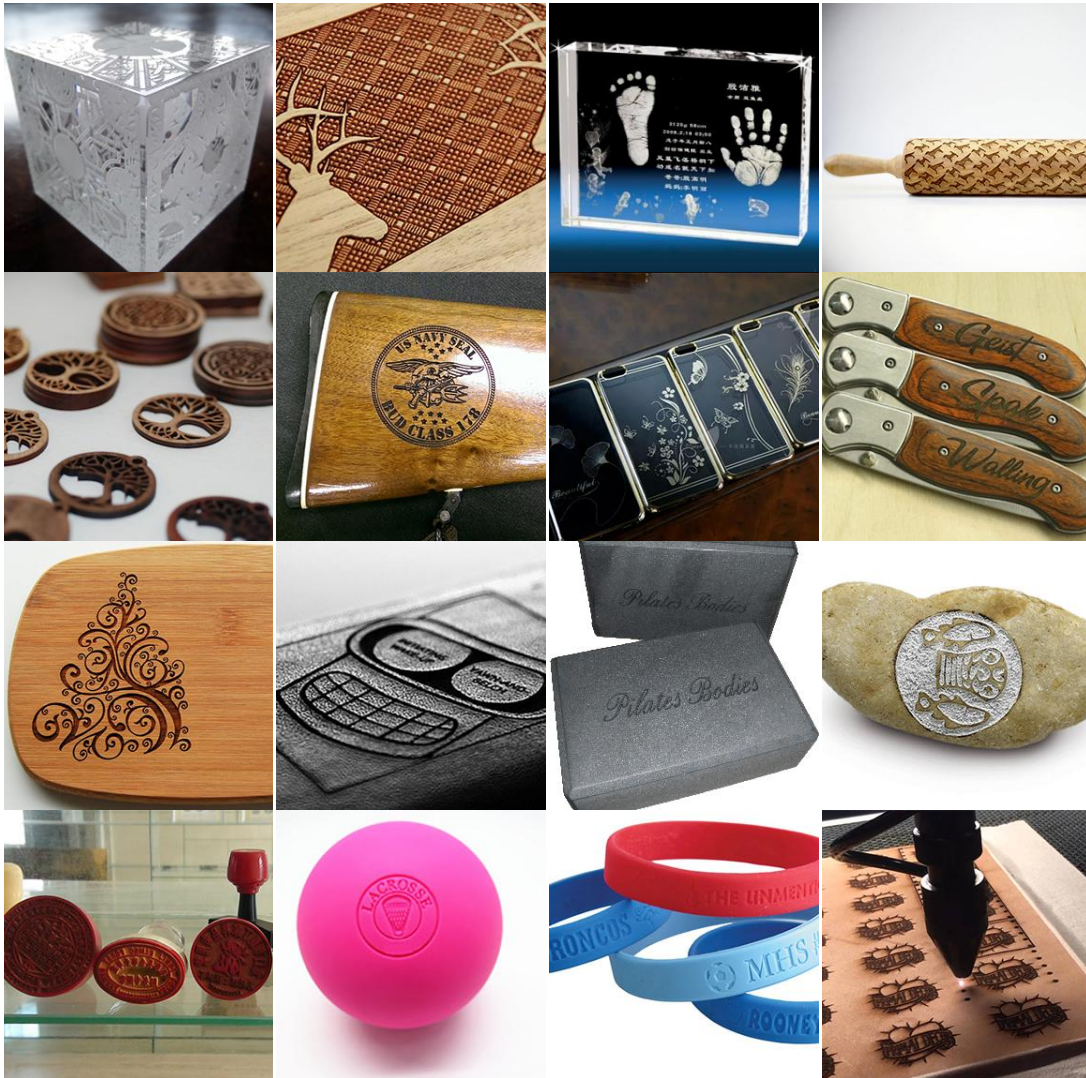
Engraving Process

The laser uses the laser radiation "light beam" as the engraving tool. There is nothing mechanical touching the materials being engraved. This is a nice feature of laser engraving, because there will be nothing required to hold the part in-place as its being engraved. With other forms of engraving the fixtures required to hold or move the part can become very elaborate adding to setup times.

Laser engraving is the process of actually removing material away leaving a trough much like the engraving performed by mechanical machines. Laser engraving is more suited to applications where aesthetics are of key importance and strength of the material is not as much of a concern. This is a bit of a generalization and won't always be the situation.

The difference between laser etching and engraving is that with engraving the surface of the material is removed and you can feel the difference caused by the new depth when you run your finger over the surface. You can engrave all kinds of surfaces from metal, plastics, wood, leather and glass (see a more comprehensive list at the end of this document) and once the material has been removed the engraving will never wipe off.

Here are some examples of laser engraving:



At PDX Lasers we would like to help you explore any engraving ideas you have.

CO2 Laser Compatible Materials		
Material	Engrave	Cut
Wood	x	x
Acrylic	x	x
Fabric	x	x
Glass	x	
Coated Metals	x	
Ceramic	x	
Delrin	x	x
Cloth	x	x
Leather	x	x
Marble	x	
Matte Board	x	x
Melamine	x	x
Paper	x	x
Mylar	x	x
Pressboard	x	x
Rubber	x	x
Wood Veneer	x	x
Fiberglass	x	x
Painted Metals	x	
Tile	x	
Plastic	x	x
Cork	x	x
Corian	x	x
Anodized Aluminum	x	
Stainless Steel	*	
Brass	*	
Titanium	*	
Bare Metals	*	
* CO2 lasers will mark bare metals when coated		

Fiber Laser Compatible Materials	
Material	Mark
17-4 PH Stainless Steel	x
303 Stainless	x
4043 Steel	x
6061 Aluminum	x
Bayer 2807 Makrolon polycarbonate	x
Bayers Bayblend FR 110	x
Black/White ABS	x
Brass	x
Brushed Aluminum	x
Carbon Fiber	x
Carbon Nanotube	x
Clear Coat Anodized Aluminum	x
Cobalt Chrome Steel	x
Colored Delrin (Black/White)	x
Compacted Powder Iron w/Iron Phosphate Coating	x
Copper	x
DAP - Diallyl Phthalate	x
GE Plastics Polycarbonate Resin 121-R	x
Glass Filled PEEK	x
Glass Filled Telfon	x
Hard Coat Anodized Aluminum	x
Machine Tool Steel	x
Magnesium	x
Metal Plated Ceramics	x
Molybdenum	x
Nickel Plated 1215 Mild Steel	x
Nylon	x
Polybutylene Terephthalate	x
Polysulphone	x
Rynite PET	x
Santoprene	x
Silicon Carbide	x
Silicon Steel	x
Silicon Wafers	x
Various Inconel Metals (Nickel-Chromium Super Alloys)	x
White PEEK	x
Yellow Chromate Aluminum	x
Zinc Plated Mild Steel	x
* Fiber lasers can cut through some thin metal foils	