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THE ULTIMATE LASER MARKING GUIDE

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LASER ETCH VS. MARK

When discussing laser marking, there is a misconception regarding the terminology being used. “Laser etching” is more of a broad term that is commonly used to describe what the laser’s capabilities are and not specific to types of materials, industry requirements, and or real application solutions. We want to break down the different types of marking that is accomplished with a 1064nm fiber laser and specific applications to those types of marking.

Fiber marking systems can mark or “laser etch” many different materials such as metals, plastics, and ceramics, all in contrast. Contrast marking is the discoloration of any material that either makes a lighter in contrast or darker in contrast permanent mark on the substrate material. Let’s break down some of the most common markings and materials associated with “laser etching.”

1. OXIDATION

Oxidization is the process of microscopically raising the surface of a metallic material while oxidizing the top layer of material. This creates a darker contrast marking mostly resulting in a black mark. Ferrous materials mark very will with this type of marking. While non-ferrous metals can be marked in this manner, it usually takes longer to get the desired contrast. Some of the most common industries and uses of this type of marking include automotive, aerospace, defense, industrial and oil & gas. Oxidization marking or laser etching with a 1064nm fiber laser can be achieved by high power settings, low scan speed and low frequency settings.

Types of materials mostly marked (laser etched) in this manner include steel, cast iron, stainless steel, precious metals, aluminum and brass alloys.

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2. ETCH

Etching is the process of microscopically ablating or removing material from the surface of any metallic substrate. This creates a cavity for ambient lighting to reflect into the cavity and give the appearance of white to the human eye. “Etching” is one of the fastest marks that can be created with a 1064nm fiber laser marking system. Etching marks are utilized in a wide variety of applications alone or in conjunction with an oxidized mark. Etching is used on all metallic surfaces such as steel, stainless steel, cast iron, brass alloys, bare aluminum, and coated metallic surfaces. Examples include: Anodized aluminum, mil-spec coated alloys, TIN, Nickel, Chrome, and more. Most common uses of an etch mark on materials are commonly used in the automotive industry, industrial manufacturing, oil & gas, aerospace, defense and many more facilities for tracking and traceability purposes.

When utilizing both an oxidization and an etch mark on metallic surfaces one can gain much more contrast when marking 2D codes. Please see photo for example. Etching marking or laser etching with a 1064nm fiber laser can be achieved by high power settings, high scan speed and higher frequency settings.

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3. ANNEALING

Annealing is a process that is unique in the laser marking industry to medical and aerospace applications. Annealing ferrous metals creates a black marking below the surface of the parts. Annealing can only be achieved on ferrous materials due to the carbon content. When annealing materials there is no disturbance in the outer most layer of the parts which allows for corrosion resistant permanent marking. Annealing is done with median power settings, slower scan speed, and lower frequency settings. Another setting that must be present is utilizing the diverged portion of the beam. Where all other marking is done with the focal point of the laser, an annealed mark/etch must use the less focused portion of the beam to heat up the substrate to draw carbon to the surface all while not disturbing the surface. 1064nm can anneal all ferrous metallic materials; such as stainless steel (all alloys), titanium, and Inconel.

4. DEEP ENGRAVING

Deep engraving is a type of marking that can be accomplished with a 1064nm fiber marking system. When using a fiber laser to do “deep engraving” types of marking/etching there is a specific way to gain the required depth of mark. Essentially deep engraving is ablating the surface of a metallic surface very quickly while doing so with many repetitions. When talking about deep engraving or cutting with a laser, it can be done with any wattage system, although wattage is a determining factor in depth of mark and cycle time. Normally when presented with a marking application that has a depth specification for either Firearms, Aerospace, defense, or oil and gas industries Beamer recommends starting off with a 50W marking system. In the firearms industry Beamer has found that a 100W marking system is much more efficient at marking the required ATF/FFL markings outside of the machine tool freeing up valuable manufacturing time. Deep Engraving marking is limited to metallic substrates such as steel, stainless steel, Inconel, aluminum, and others. Deep engraving can be accomplished by using these settings on your marking system. Highest power settings, fast scan speed, and median frequency settings while repeating the same marking until reaching the required depth specifications. In the instance of a very significant depth specification, the Z-Axis may need to be re-positioned to make us for the loss of focal range.

5. FOAMING AND CHARRING

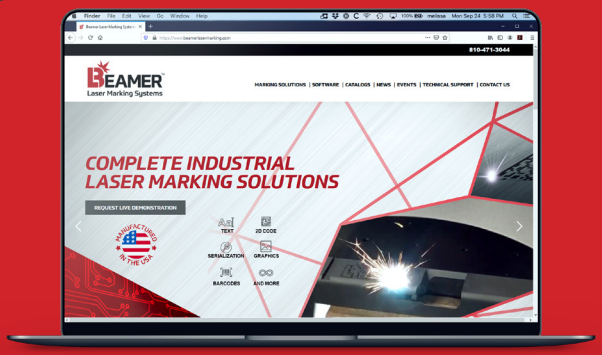
Foaming and charring are markings that are specific to polymers. There is a wide range of plastics / polymers and resins that mark very well. Foaming and charring are essentially the same marking but in different contrasts. When marking a light plastic / polymer and creating a darker contra mark the mark is “charring”. On the other hand, marking a dark plastic / polymer with lighter in contrast marking is “foaming”. Microscopically what is creating the marking on the material is microscopic bubbles in the plastic at the surface of the material in a very precise manner. This is a permanent marking that lasts for the life of the part / component. An example of these types of marking we like to use is in the automotive industry. If you were to open your fuse box on your vehicle, the marking of what fuse is designated for most likely has been created by foaming the plastic sub straight to create a permanent marking that is resistant to the elements for the life of the part. Foaming and charring is possible on a multitude of materials such as, ABS, LDPE, HDPE, Nylon, Peek, and many others. Some plastics that do not mark as well include white Delrin and clear plastics. We have noticed industry wide as well with glass filled polymers. Material with over 30% glass fill can have some difficulty marking due to the reflective nature of the glass in the material.

Industries that utilize foaming and charring types of marking include Automotive, Medical Devise, Medial Supplies, Dental Instruments, Medial Disposable products, R&D Facilities, Food Pack, and many more. Settings for a 1064nm fiber marking system vary greatly for each type of material. Utilizing Beamer’s test marking capabilities to finds the optimal settings for each material.

BEAMER LASER HAS THE SOLUTION FOR YOUR OPERATION AND INDUSTRY.

Beamer Laser Marking Systems delivers American-made quality in a full range of fiber laser marking machines, providing an industry-leading 100,000+ working-hour lifespan. With simple point-and-click software, Beamer Laser has what your operation needs – whatever its focus. From tracking and traceability, serialization, 2D codes, and decorative laser marking; in industries from automotive to medical and many others. Save production time and boost productivity with these affordable solutions.

Beamer offers user-friendly Standalone Solutions, as well as custom Engineered Solutions and Inline Solutions – all provided with fast turnaround times to maintain productivity. Whatever your direct part marking needs, Beamer Laser has the solution that will enhance your product quality and assure your operation a competitive edge.



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