

# "The Scoop" On Metal

By Jackie Zack



DuraBlack (left image) and AlumaMark (right two images) are aluminum substrates designed especially for laser engraving. Photo courtesy of Johnson Plastics.

**W**hat is it about metal? There's no question that plastic substrates have their place in the awards and personalization industry and, over the years, we've seen notable advancements in the plastics available for engraving and sublimation with more choices available today than ever before and higher quality materials. There's no question that it's a good material choice for many applications...but there is also something very special about metal. A shiny brass diamond engraved plaque, an anodized aluminum plate laser engraved with a detailed photo or an aluminum panel sublimated with a full-color image—these all exude "high-quality" and customers notice this when making a purchase. Metal definitely has a place in your inventory, whether you engrave, laser engrave, sublimate, screen print or use digital inkjet printing.

Of course, choosing an ideal substrate depends on the job. Compared to plastic, metal does have some disadvantages for certain applications. For example, it can corrode, the engraving may darken over time and metal's rigidity can be a disadvantage for situations where the material needs to have some flexibility such as a nameplate for a curved stadium chair.

That being said, metal does have numerous advantages for many applications that shouldn't be overlooked. Most notably, particularly for products like plaques, nameplates,

signage, etc., is the look, feel and weight of the material. In many cases, metal has a shiny, high-quality look, a smooth feel and more weight that puts it a notch above plastic. In addition, coated metals, such as lacquered brass and anodized aluminum, typically have a very thin coating (thinner than the cap material on many plastic engraving stocks) that is excellent for fine detail engraving.

Metal also has characteristics that are important in certain environments, including hardness, chemical resistance, heat resistance and noncombustibility. For example, hospitals often require equipment identification that will endure harsh cleaning solvents and control panels in aircraft cockpits need to be noncombustible and should not produce toxic fumes if exposed to fire. Depending on the specific type of metal, this substrate can also have important weatherability qualities, including resistance to severe heat, cold, precipitation and abrasion as might be required for exterior signage at a golf course, zoo or park. For some helpful information about which various materials and processes are suited for the environment, refer to the Material/Processes chart accompanying this article.

In this industry, you can buy metal by the sheet and fabricate it into trophy plates, plaque plates, badges, nameplates and other custom products. As another option, you can purchase pre-cut plates that are designed to "mark and go," including various shapes and sizes of plaque plates, badges, tags and specialty items like gavel bands and license plates. You can also select from a wide variety of miscellaneous award, gift and specialty items like ID bracelets, tankards, watches, pens, knives, etc., and industrial metal pieces like legend plates and control panels. In all of these instances and more, metal clearly fits the bill.

Metal sheet stock for engraving and sublimation is available from a number of engraving and sublimation material suppliers and distributors in the industry. For a list of suppliers, check out the **2016 R&P Directory** which is published in the December 2015 issue and is also available online at [www.enraversjournal.com](http://www.enraversjournal.com).

The most popular methods for in-house marking on metal in the personalization industry are rotary engraving, laser



ChromaLuxe sublimatable aluminum is known for its ability to create photographs with striking clarity and color. Photo courtesy of Condé Systems, Inc.

engraving and sublimation. However, other personalization methods are available and well-suited for some jobs. That list would include etching, screen printing and, of course, the new emerging technology of digital printing.

Interestingly, there's a long list of metals to work with for each of these methods—longer than ever before, particularly for laser engraving and sublimation. As with most materials, some metals work best with either laser engraving, rotary engraving or sublimation, and today you can even find metals that work well with two or even all three methods.

Here's a look at these three methods along with the "scoop" on the types of metal that they can be used to mark.

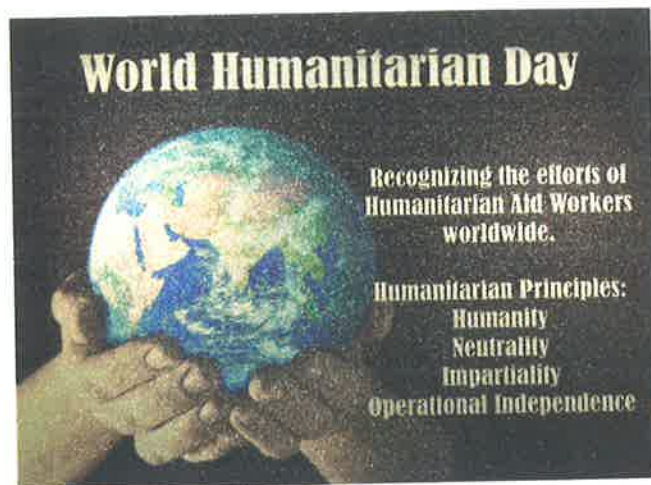
#### Rotary Engraving Metals

The term "rotary engraving" in our industry actually encompasses several different engraving methods, including diamond engraving, burnishing and (true) rotary engraving. These three techniques can all be used to

engrave certain trophy and engraving metals in the industry. Here's a brief synopsis of these engraving techniques.

**Diamond Engraving:** Also known as "diamond drag" engraving, this technique involves using a non-rotating highly polished bullet-shaped grav-

er with an industrial diamond set in the tip. Basically, you "drag" the diamond graver across the metal to create a narrow, delicate, brilliant cut that actually makes a groove in the metal. Unlike most marking methods, diamond drag engraving is an excellent marking method for nearly any type of metal,



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The beauty of diamond engraving is that it can be used to engrave directly on metal, such as this stainless steel flask. Photo courtesy of Gravograph.



One of the most significant advantages of a fiber laser is that you can engrave almost any metal, including satin brass.

including brass and aluminum, as well as metals with all types of plating and surface finishes, and a number of "un-machinable" hard and tough alloys.

With diamond drag engraving, the groove produced is rather narrow, typically .005" to .007" and just a few thousandths deep. For larger letters where you need a wider "stroke," you can achieve this by using multi-line type fonts. The shallow depth of diamond engraving also does not allow paint filling, although chemical oxidizers are available to add contrast to the engraving.

**Burnish Engraving:** This engraving process utilizes a rotating faceted burnishing cutter and a burnishing adapter which fits in the rotary spindle of an engraving machine and provides a very delicate downward spring action of the spinning cutter against the metal. This technique is used on different kinds of engravable, coated metals such as enamel-coated brass and aluminum. The carbide or diamond-tipped burnishing cutter removes the coating on the metal and just a minute amount of the metal itself, e.g. .001"-.005". The result on coated metals is very distinctive and attractive. Characters and designs are

bright but very shallow. An advantage to burnish engraving is you can use different cutter tip sizes to give you a wide selection of letter stroke widths, even using single-stroke type fonts which are very quick to engrave.

**Rotary Engraving:** Metal is also commonly engraved using a traditional rotating bit. Although the traditional rotary engraving process is a little more involved and problematic than diamond engraving, rotary engraving works on most trophy/engraving metals, including aluminum and brass. Like diamond and burnish engraving, the rotating cutter actually removes some of the metal as it cuts. However, unlike both diamond and burnish engraving, you can achieve very deep cuts, extremely shallow cuts or any depth in between. In addition, various cutter sizes are available which allow you to produce wide-stroke characters or thin-line cuts. Note, too, that you can profile, slot and hole cut most metals using a parallel cutter (in a tip size .060" or larger to avoid cutter breakage) or a multi-flute end mill.

Rotary engraved cuts are deep enough for paint filling and provide an extremely permanent mark that won't "wear away," even in hazardous environments.

One of the noteworthy problems you'll encounter when you rotary engrave coated metals such as trophy brass and aluminum is that the depth regulator nose found on most engraving machines can create scratches in the surface coating due to the presence of metal chips.

Metals for rotary engraving need to be "free-machining," meaning they contain a small amount of lead which makes it easier to engrave using rotary cutters. Most (but not all) of the trophy and engraving metals sold in this industry are free-machining, but be sure before you make a purchase. Now let's take a closer look at the metals.

**Brass**—This soft metal usually has an ultra-attractive gold appearance, making it popular for a variety of uses. You can purchase either sheets or blanks in either bright or satin finishes

typically in .020" and .025" thicknesses. As mentioned, most of the brass available in the industry is free-machining.

Brass for engraving is usually polished and then finished with some type of air-resistant coating on one side. For example, lacquer-coated brass has a clear lacquer coating while the enamel-coated version is covered with opaque enamel. The colored enamel provides a very attractive contrast with the shiny gold engraved areas. Black is a popular enamel color, although there are many different colors and patterns to choose from. Brass either plated or alloyed with another metal, like chrome or nickel, is also an option in this material. Some brasses have a white silvery color and others look more like bronze.

**Aluminum**—This metal is soft and has a whitish-silver color. Although not quite as attractive as brass, it is a more economical choice—aluminum generally costs about half the price per sheet.

Aluminum is available in polished and finished sheets or pre-cut blanks and is typically .020" thick. Lacquer-coated aluminum has a clear or color-tinted coating or you can select aluminum coated with opaque enamel. Anodized aluminum is characterized by a very durable matte-finished coating (available in various colors) and is also a popular choice for some award and gift applications, although it is more commonly preferred for industrial tag work.

You will find a huge selection of aluminum-based materials available, including aluminum sheets with a brass-coated surface and plenty of variations in colors, textures and surface finishes.

**Stainless Steel**—Stainless steel, a metal primarily made up of iron, chromium and carbon, usually has more specific applications than aluminum and brass. This metal is strong, durable, inert and heat-resistant, making it popular in industrial environments for uses such as control panels and machine parts. This metal is unlike the metals we commonly use for standard rotary engraving which requires a few different techniques and procedures. Primarily, the grade of stainless steel you are engraving must be machinable. Steel manufacturers use a set of

numbers to grade the machinability of steel. In general, those in the 400 grade range are the easiest to engrave although some 200 and 300 grade steels may be engravable too. In any case, always check with the supplier to ensure that the steel you are engraving is indeed rotary engravable.

**Adding Color**—You can add color to engraved metal using several different techniques. As mentioned, one is to use a chemical oxidizer. Chemical oxidizers are used on diamond

drag, burnished or rotary engraved lacquer-coated metals to turn the engraved grooves black which make them stand out against the shiny metal background. Chemical oxidizers can be purchased in several formulations (aluminum and brass require separate solutions) and are available from most engraving material suppliers.

Another option is to use lacquer sticks which are crayon-like sticks of pigment which you rub over the engraved grooves. Lacquer sticks work

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best for filling thin-lined engraving with a depth of .005"-.010".

Paints are another option for color filling rotary engraved metal. Oil-based enamels are the most popular because they look good and are durable. Latex paints and lacquers can also be used on rotary engraved metal.

#### Laser Engraving

In general, there are two types of laser systems used in commercial engraving, including CO<sub>2</sub> and fiber lasers. Each of these lasers is well-suited for engraving different types of material.

A CO<sub>2</sub> laser, which is the most popular laser used for engraving in our industry, is well-suited for engraving and cutting many non-metal materials such as wood, plastic, glass, ceramic, leather, solid surface material, etc. Bare metal and other reflective surfaces do not absorb the light generated by CO<sub>2</sub> lasers as well as fiber lasers. Instead, metal acts like a mirror by reflecting the CO<sub>2</sub> laser beam. For this reason, most CO<sub>2</sub> lasers cannot engrave bare metal. Instead, a CO<sub>2</sub> laser makes a mark by removing the coatings on metal, such as the enamel on brass or the anodized layer on aluminum. CO<sub>2</sub> lasers can also mark many bare metals if they have been treated with a laser-markable chemical such as CerMark.

Fiber lasers, on the other hand, are

optimally suited for marking metal, including metals like lacquer-coated brass and most bare metals. They do this by way of "annealing" as opposed to actually cutting the metal or removing a coating. In laser jargon, this is the process of firing the laser beam at the metal surface which causes it to absorb a great deal of heat that, in

turn, causes a color change in the metal resulting in a permanent mark.

Although technically most coated metals can be engraved with a CO<sub>2</sub> laser, standard trophy and engraving metal is not designed for engraving with a CO<sub>2</sub> laser. As such, the popularity of these lasers for engraving prompted the invention of metals de-



Pre-cut brass plaque plates are available with many interesting patterns. Photo provided by LaserBits, Inc.



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signed specifically for CO<sub>2</sub> laser engraving applications.

The difference is that most laserable metals are double-coated, so to speak. First, a piece of brass, aluminum or steel is polished to a high luster (giving it its bright appearance) and then it's coated with a clear lacquer protective coating. Next, a densely-coated colored top coat is applied. When the material is engraved, the laser will cut through the top coat, but not through the clear coat, revealing the bright, shiny metal which is still protected from aerial oxidization by the clear lacquer layer.

With regular engraving metals designed for mechanical engraving, the metal sheet is often not polished before the top coat is applied because it is assumed the metal will be diamond or rotary engraved which removes tarnished metal and exposes clean, new metal. So, if you try to laser some engraving metals, you may end up with tarnished metal that you will have to polish yourself. Dual-coated lasera-



The inside areas of this logo were burnish engraved with overlapping cutter strokes on black brass to create an attractive bright gold effect.

ble metals save you this extra step and provide the added benefit of protecting the engraving from tarnishing even after years of exposure to the atmosphere.

Here's a look at metals that can be

laser engraved along with metals designed specifically for laser engraving with a CO<sub>2</sub> laser.

**Anodized Aluminum**—Typically, any anodized aluminum product can be laser engraved. This material offers extremely high detail and contrast, and is especially well-suited for engraving photos. It is also commonly used as an exterior material, although unless it has a coating it is not really UV stable and may eventually fade.

**AlumaMark**—AlumaMark, manufactured by Horizons Inc., is an aluminum material designed specifically for laser engraving. This aluminum material is treated with a proprietary "specialty coating" that absorbs CO<sub>2</sub> laser energy. When the laser hits the material, it turns the surface black, providing excellent contrast between the engraved characters and the background. AlumaMark is available in silver, gold, bronze, brass and an assortment of colors and finishes. It is used for a variety of interior applications, such as plaques, trophy plates,

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labels, nameplates, badges and interior signage. It's especially well-suited for reproducing photographic images.

**DuraBlack**—DuraBlack is also manufactured by Horizons Inc. and is a CO<sub>2</sub> laserable black anodized aluminum designed to be extremely durable, even in harsh operating environments. DuraBlack is resistant to UV light, abrasion, high-temperatures, salt spray and chemical exposure. Because of its ability to perform across a range of challenging environments, DuraBlack meets several government, industrial and military specifications and is rated to withstand harsh environments for 10+ years. The .005" thick material is flexible enough to bend around curved surfaces, while the .020" thick material is designed for jobs demanding greater rigidity and durability. Common applications include outdoor signage, property tags, barcodes and industrial tags.

**Laser-Markable Coatings**—For those times when you want to mark metal that is not designed for CO<sub>2</sub> laser engraving, such as stainless steel, titanium, chrome, steel or other uncoated metals, a laser-markable chemical such as CerMark may be the solution. CerMark is available as a spray, a brush-on solution and a tape. You simply apply the chemical to the metal and then engrave with your CO<sub>2</sub> laser. The heat from the laser causes the coating to turn black and fuse to the surface, creating a permanent black mark.

**Adding Color**—Adding color to laser engraved metal is typically not an option using conventional methods like oxidizing and paint filling. Oxidizing does not work on metal designed specifically for laser engraving due to the added clear coat, and paint fillers do not work because there is little or no depth to the marked areas



Anodized aluminum laser engraves beautifully, especially for photographs. Photo provided by Kern Laser Systems.

since only the micro-thin coating on the metal is removed or the surface has been annealed.

#### Sublimation Metals

Sublimation has been around the industry for quite some time but has recently enjoyed renewed popularity, primarily due to new and innovative applications. The process involves printing a reverse-reading transfer using special sublimation toners (laser sublimation) or inkjet dyes (dye sublimation). Then the transfer is placed face down on the substrate and a heat press is used to imprint the image onto the substrate.

For most substrates to be sublimatable, they must be coated with a polyester-type coating that the sublimation dyes can bond to. When applied with a heat press, the sublimation dyes are embedded in the coating to create multicolor images.

For years, the primary applications for sublimation were wearables and



A wide variety of engravable products made of metal are available in the industry that can be personalized, such as this purse hanger. Photo courtesy of Trotec Laser.

single-color images on metal plates, but now you can sublimate a wide variety of products and materials, including metal. You can purchase sublimatable metal by the sheet or select from an expanding selection of products, including pre-cut plaque plates, badges, metal inserts (for various products like medallions and compacts), desk accessories, serving trays, key tags and more. The applications for sublimated metal are virtually endless.

The most common type of sublimation metal is aluminum, and today the three most popular metals are sold under the brand names ChromaLuxe, Unisub and Dynasub.

**ChromaLuxe**—ChromaLuxe is a premium line of sublimation aluminum manufactured by Unisub. One of the main features of ChromaLuxe is that it has a rather thick high-quality polyester coating on the metal that is thicker than the coating on standard sublimation aluminum. Many users

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Using a laser-markable chemical such as CerMark allows you to engrave bare metals such as stainless steel with a CO<sub>2</sub> laser to create a permanent black mark. Photo courtesy of LaserBits, Inc.

claim that this material, although the most expensive, is the ideal material for sublimating photographs. The ChromaLuxe coating is also resistant to UV light, fading, scratches and chemicals.

According to David Gross, president of Condé Systems, Mobile, AL, ChromaLuxe is the top-of-the-line in sublimation metal. "This metal has gone viral in the photo industry because it produces amazingly deep rich colors due to the extra thick coating and optical properties. It is the standard now for all other metals. Because of the thickness of the coating, images

appear to have a slight, but noticeable, 3D effect," says Gross.

ChromaLuxe metal stock is .045" thick and is available in sheet sizes up to 4' x 8'. You can cut the material with a shear and also fabricate it with equipment such as hole punches and corner rounders. The metal is available in white, clear (silver) and gold colors in glossy, semi-matte and matte finishes.

ChromaLuxe sheet stock is also available with the sublimation-receptive coating applied to both sides of the sheet, which introduces some unique two-sided applications for the material. For instance, you can sublimate an image on both sides of the material and then use a metal rolling device to form the flat metal into a curve, creating a unique and attractive self-standing photo display.

**Unisub (metal)**—This metal is similar to ChromaLuxe but has a slightly thinner coating and is often used for projects that require a more economical metal. The Unisub aluminum is .030" thick and is sold in sheet sizes up to 4' x 8' in white, clear (silver) and gold colors with a glossy or matte finish. Like ChromaLuxe, Unisub metal is also resistant to UV light, fading, scratches and chemicals.

**Dynasub**—A third type of sublimation aluminum available in the industry is sold under the brand name



A variety of metals including stainless steel, aluminum, brass, copper and nickel silver can be used to create industrial products such as tags and nameplates. Photo courtesy of Identification Plates, Inc.

Dynasub. This metal has a thinner polyester coating than ChromaLuxe and Unisub, is not as resistant to UV light and is less scratch resistant. It does, however, reproduce crisp, full-color images and is less expensive than the other sublimation metals. Due to its low cost, it is often a favorite metal for typical awards and name badge applications. DynaSub aluminum is .020" thick and is sold in 24" x 12" sheet sizes in satin gold, satin silver and gloss white.

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# Material / Process Chart

Information supplied courtesy of Identification Plates, Inc.

MATERIALS	PROCESSES																							
	Chemical Etch				Screen Print				Sublimation				Digital Print				Laser Engrave				Rotary Engrave			
	ENVIRONMENT																							
	Mild Interior	Harsh Interior	Mild Exterior	Harsh Exterior	Mild Interior	Harsh Interior	Mild Exterior	Harsh Exterior	Mild Interior	Harsh Interior	Mild Exterior	Harsh Exterior	Mild Interior	Harsh Interior	Mild Exterior	Harsh Exterior	Mild Interior	Harsh Interior	Mild Exterior	Harsh Exterior				
Aluminum																								
Anodized	X	X	X	X	X	X	X	X									X	X	X	X				
Coated					X	X	X		X	X									X	X				
Painted					X	X	X	X	X	X			X	X	X		X	X	X	X				
Brass																								
Coated	X	X	X		X	X	X		X	X							X							
Copper																								
Coated	X	X	X		X	X	X		X	X									X	X				
Nickel Silver																								
Coated	X	X	X		X	X	X		X	X									X	X				
Stainless Steel																								
Uncoated	X	X	X	X	X	X	X	X									X	X	X	X				
Non Metallics																								
Polycarbonates					X	X	X	X					X	X	X	X								
Mylar					X	X							X	X										
Vinyl					X	X							X	X										

## Environment Glossary

- Mild Interior** Indicates the product is resilient to a normal indoor environment and will show no signs of deterioration when placed therein.
- Harsh Interior** Indicates the product can withstand extreme indoor temperatures, humidity, and polluted air in those conditions that may lack sufficient heating, air conditioning, and/or filtering.
- Mild Exterior** Indicates the product can withstand a mild to moderate outdoor environment.
- Harsh Exterior** Indicates the product can withstand a moderate to extreme outdoor environment, including severe heat, cold precipitation, and abrasion.

According to Gross, there is a fourth tier of metals that are sold as "sublimation metals" under names that are similar to Dynasub that he does not recommend. "In reality, these metals are extremely poor at color saturation, abrasion resistance and clarity, and should be avoided," he says.

**id-Sparkle**—ID Plates has introduced a very interesting metal product that falls into the "specialty metal" category. One of the most interesting characteristics is that it can be used with either sublimation or laser engraving, and it's also possible to do a job which combines the two tech-

nologies. Available in aluminum and brass-plated steel, id-Sparkle has a special "glittery" textured coating applied to it that can be sublimated and laser engraved. Coatings available include gold, silver, bronze and platinum. The material is sold in 12" x 24" sheets and is available in .015"-.018" (steel) and .020" (aluminum) thicknesses. Although not recommended for small, fine detail, this product has some unique applications when a customer is looking for something different.

### Conclusion

Although this article has focused

on the primary marking methods of rotary engraving, laser engraving and sublimating, most metals can also be marked with screen printing and digital inkjet printing so keep those options in mind as well.

Regardless of the marking method(s) you use, there are plenty of options to choose from when it comes to metal substrates. Metal can be a very classy and attractive material for many different products and applications, and your customers are sure to appreciate the option. So, the next time you have a job for metal, remember the "scoop"! 