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CerMark

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Aerosol Spray Cans

markSolid laser marking materials for the Industry

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Marking on Metals

markSolid products for metal marking produce permanent markings, highly resistant against mechanical and chemical strain as well as high temperatures (> 1000°C, depending on the metal). The products are suitable for use with CO_2 lasers and Nd:YAG and fibre lasers.

One of the most common uses is the marking of stainless steel. Furthermore, the products may be used for marking non-ferrous metals, precious metals, or metal coatings. Unless otherwise indicated, the products may be used universally and for various metals.

Determine the required laser settings depending on the metal to be marked. Stainless steel has the lowest requirements for the marking laser. Based on this, some metals or metal coatings require higher energy for marking. Equally, the rule of thumb applies: the better the heat conduction of the metal, the more energy required for marking.

Anodised aluminium holds a special position amongst the metals. The all-round metal marking products are not as suited for this or will not work with most types of anodised aluminium. Please use products specially developed for the marking of anodised aluminium.

Several options are available for the application of the marking material to the metal surface.

The most common and also most convenient method is aerosol coating.

Brushing is only a good alternative when the entire surface can be coated with only one brush stroke.

Spraying of the liquid/paste products, e.g. using airbrush, makes sense when coating larger surfaces in one work step.

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Aerosol Cans

Efficient Use and Comfortable Handling

The aerosol spray can allows for efficient, time-saving and very convenient application of the laser marking material.

This often makes the can the most economical solution. Set-up times due to thinning adjustments, preparation of the airbrush equipment and its subsequent cleaning are completely omitted.

A thinly applied layer - just enough for covering - is beneficial compared to a thicker layer. A thicker layer requires higher laser energy. A very thin coating will create lighter markings.

After completion of the laser marking process, make sure to remove the excess laser marking material.

The soft spraying system of the markSolid aerosol creates a smaller spraying mark and effectively reduces overspray.

Aerosol cans according to the *markSolid standard* automatically clean the valve and spray head and can be placed back on the shelf after use without requiring any care.

➔ See also "*Information on Aerosol Cans*"

Product	Colour	Intended Use	Characteristics
markSolid **114**	Black	**All-round** metal marking material, perfectly suited for stainless steel and other metals, including polished surfaces. The sprayed layer is powdery and easy to remove after the laser marking process. The benefit of a powdery layer is that the heat expansion of the metal underneath the layer never causes separation of the coating during the laser process and thus prevents subsequent marking errors. *markSolid 114 complies with the markSolid standard for aerosol cans.*	Developed for **highest durability at the same time highest marking speed** Very good blackening Highly reliably working aerosol spray can with excellent spraying characteristics
LMM **6000** *CerMark*	Black	**All-round** Metal marking material, preferably for stainless steel. For non-ferrous metals, lasers with higher performance are beneficial. The sprayed layer is dry to the touch after drying and allows the stacking of signs, etc. *LMM 6000 complies with the US standard for aerosol cans.*	**Dry to the touch coating** before laser markings Very good blackening and durability

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Liquid/Paste Products
Application with Airbrush or Brush

When applying the product, it is important to apply a thin layer as evenly as possible. For this reason, as an alternative to brushing, spraying (e.g. using airbrush) is always the better option. We only recommend brushing for small surfaces and only when it is possible to coat the entire surface with only one brush stroke.

A thinly applied layer - just enough for covering - is beneficial compared to a thicker layer. A thicker layer requires higher laser energy. A very thin coating will create lighter markings.

After completion of the laser marking process, make sure to remove the excess laser marking material. Use water for moistening. Solvents, etc. are not required.

Product	Colour	Intended use	Characteristics
markSolid **015**	Black	All-round metal marking material, perfectly suited for stainless steel and non-ferrous metals, except brass and glossy surfaces that are liable to a matting effect (in this case use the markSolid 026 or an markSolid aerosol can). The sprayed layer is powdery after drying and easy to remove after the laser marking process. The benefit of a powdery layer is that the heat expansion of the metal underneath the layer never causes separation of the coating during the laser process and thus prevents subsequent marking errors. After applying the product, the drying can be accelerated by means of hot air.	Developed for **highest durability at the same time highest marking speed** Good blackening Water-based product → can be diluted with water or Alcohol
LMM **6000** *CerMark*	Black	**All-round** Metal marking material for black markings, preferably for use on stainless steel. Higher laser performances are beneficial for non-ferrous metals. A coat applied with the Airbrush or brush is dry to touch after drying and allows a cautious stacking of pre-coated plates.	**Coating is dry to touch** before laser markings Good blackening Good resistance
markSolid **904**	Black	The solution to inexpensively mark **anodised aluminium** in large quantities or on large surfaces. Marks every type of anodised aluminium Airbrush is the recommended application method. Depending on the laser, slight defocusing may significantly improve the results. May require some training time and more precise application compared to the other metal marking products.	Good blackening Very good resistance Requires more precise work when applying the product (→ thin coating)

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Transfer tape

For manual application from the roll

Laser transfer tape is a self-adhesive roll of various widths which is simply stuck to the marking surfaces in the required lengths.

When marking, the laser transfers the colour from the transfer tape on to the surface to be marked. In the process, the marking from the transfer tape is "cut off".

After marking, the remaining parts of the transfer tapes are removed again.

Product	Colour	Intended Use	Characteristics
LMM **6018** *CerMark*	Black	We recommend the product for marking on **anodised aluminium**. In addition, it's also suitable for marking other surfaces. Usually liquid/paste or aerosol spray can products produce better results at higher marking speeds. The transfer tape can be an alternative in cases where spraying or brushing must not be used. Higher laser performance is beneficial. Otherwise, the marking speed could be very slow.	**Very easy handling**

Screen Printing

In screen printing, the laser marking material is only applied to those positions which need to be marked afterwards. For example, application is carried out as a rectangular area within which the marking takes place. After successful laser marking, the excess material is washed off.

Product	Colour	Intended Use	Characteristics
LMM **6012** *CerMark*	Black	All-round metal marking material, preferably for stainless steel. For non-ferrous metals, lasers with higher performance are beneficial. The printed-on layer is dry to touch after drying and allows cautious stacking of pre-coated signs in stock. The properties of the markings are like those of LMM 6000.	**Dry to the touch coating** before the laser markings Very good blackening Good resistance Kiln drying required

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Information on Aerosol Cans

For aerosol cans to create a clean spraying pattern and perfect coating, it is most important to provide a perfect interplay of the spray head, the liquid content, and the pressure ratio inside the can. The manufacturer coordinated these elements in the development of the aerosol can.

By considering a few basics regarding the handling of the aerosol can, you as the user will be able to maintain the aerosol's optimal characteristics over its entire life.

- Aerosol cans work best at normal room temperature. Allow enough time for the aerosol spray can to heat or cool to room temperature (e.g. after several hours of transport in the freight truck).
- An aerosol can cools itself during spraying due to the propellant gas expansion inside the can. For this reason, when spraying for a long time without noteworthy interruption, the pressure inside the can reduces and causes the spraying pattern to worsen after some time. When spraying very large surfaces, we recommend that you alternate between several spray cans to allow the cans to heat back to room temperature in between sprayings.
- When spraying, always push the spray head as far as it will go.
- Extended non-use of an aerosol spray can will cause the solid ingredients to deposit at the bottom of the can, in some products more than in others. Therefore, it is crucial to always shake the can prior to use for a while to allow the contents to properly mix again. After shaking for a few seconds, you will hear the mixing ball inside the can. Only then will the ball start to work. Do not stop shaking at that point but keep shaking the spray can for some time when the mixing ball is audible.
- Always shake aerosol cans with your hand, never with an automatic shaker. These machines are much too powerful and can cause damage to the inside of the can and consequently its premature failure.

markSolid Standard for Aerosol Cans

markSolid aerosol cans feature increased spraying efficiency and reliable functionality to the last drop. markSolid aerosol cans are manufactured in Germany and provide characteristics that help the user save valuable time and money:

- Two spray heads with different spraying properties (round and flat steel) allow for better adaptation to the surface to be sprayed.
- Spraying is possible even at short spraying distance. The smaller spray cone allows for economic use even with small surfaces requiring coating.
- After use, simply place the aerosol can back on the shelf. Spray head and valve do not require complex cleaning. Even the commonly required "upside-down clearing" of the spray head is no longer necessary. This saves time and does not waste any of the laser marking material.

CerMark Aerosol Cans - USA Standard

The reliable functionality of the aerosol can requires the user to consistently perform maintenance after using the can:

- Clearing the spray head and the valve, including the inlet tube inside the can, by holding it upside-down and spraying until only propellant gas without laser marking material leaves the spray head. Make sure not to waste unnecessary amounts of propellant gas.
- If needed, soak the spray head (nozzle) in warm water and then blow it through using compressed air.

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Marking on Glass / Ceramics / ...

The products produce permanent markings, highly resistant against mechanical and chemical strain as well as high temperatures.

markSolid products are generally suited for CO_2-lasers, Nd:YAG and fibre lasers. Due to the preexisting physical interaction of the laser at certain wave lengths with the material to be marked, a certain wavelength may be of advantage depending on the substrate.

Particularly with glass it is beneficial to use Nd:YAG or fibre lasers, as glass is almost fully transparent for their wave length of 1064 nm and the laser energy is only absorbed by the laser marking material.

Glass and ceramic surfaces often absorb the laser energy better at a wavelength of 10.6 µm of the CO_2-laser, which causes significantly stronger heating of the rough substrates. Therefore, when working with the CO_2-laser, the application window is slightly smaller and requires (repeated) accurate application of the layer and laser parameters coordinated with the layer thickness.

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Liquid/Paste Products for Spraying

For glass and ceramic marking we recommend product application using airbrush. Brush application would cause uneven layer thicknesses, which would significantly compromise the quality of the marking result.

It is most important to apply the product in an even layer. The laser parameters will then be optimised for the thickness of the applied layer. We recommend that you start with very thin layers. It is easier to find optimal laser settings for thin layers. Thicker layers create better coverage, but they also require more energy for marking. A layer thickness that is just thick enough to evenly cover the surface is ideal to begin with.

Unless otherwise stated, all products are suited for the marking of surfaces of glass/ceramics/enamel/porcelain/cast stone/etc. Natural stone is problematic due to the often very inhomogeneous properties of the natural product - at least from the perspective of laser marking.

Product	Colour	Product Characteristics	Special Notes
markSolid **501** *(old product name: markSolid 098)*	White	Strong white markings, good coverage even on dark surfaces. Chemically and mechanically highly resistant. Dishwasher proof, also suitable for commercial applications	Nd:YAG or fibre laser recommended
markSolid **551**	Deep Blue	Beautiful cobalt-blue markings, high mechanical resistance, however limited chemical resistance. May darken in alkaline environment May bleach in acid environment	Nd:YAG or fibre laser recommended
markSolid **560**	Green	Chemically and mechanically highly resistant markings Dishwasher proof, also suitable for commercial applications	Good for CO_2- and fibre laser
markSolid **590**	Black	Chemically and mechanically highly resistant markings Dishwasher proof, also suitable for commercial applications	Good for CO_2- and fibre laser
LMM **6044p** *CerMark*	Black	Dishwasher proof, suitable for household applications	Good for CO_2- and fibre laser

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Aerosol spray cans for labels on glass/ceramics/...

Spray cans enable timesaving and work to be carried out in comfort and are often also a very economical solution.

Set-up times, due to thinning adjustments, preparation of the airbrush equipment and subsequent cleaning, are completely avoided.

Also, please note the above "Information on Aerosol Cans".

Product	Colour	Product Characteristics	Special Notes
LMC **6044p** *CerMark*	Black	However, like LMM 6044p the aerosol can requires a slightly thicker coating, which creates a good opaque marking on glass and ceramics. Due to the thickness of the coat needed, the product is less suitable for thin and delicate structures. For these reasons we recommend the use of a liquid/ paste product. *LMM 6044p is a CerMark aerosol can and complies with US standards.*	Good opaque black markings

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markSolid Products for Industry

By this we mean products developed for specific, limited applications and used in industrial manufacturing processes. However, the products are not limited to these applications. Most products can also be used to mark other substrates.

A wealth of colour gradations is now available, each developed based on a customer template.

An existing logo, e.g., on an original ceramic, can serve as a colour template. Likewise, a color shade according to RAL can be defined as a target.

Colour measurements, e.g., in the CIELab colour space, help with an objective assessment even at spatially separated locations.

Contact us and let us advise you.

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User Manual

markSolid 114

Black Marks on all Metals

Important to know:

➔ **Shake can well before every use**
Don't stop shaking, once you can hear the pea inside the can, because this is the moment when it starts working and takes care of producing a homogeneous suspension. Subsequently, shake for at least twice this time. **The spraying can must not be shaken in an automatic shaker!**

➔ **Keep the spray can as upright as possible whilst spraying**
Within the can, a dip tube can be found which leads from the valve to the bottom of the can. It is very important that the dip tube's lower end is always dipped in the liquid within the can. When the can is partially empty and is kept horizontally, there is the risk of the dip tube aspirating only the propellant gas instead of the liquid content. This leads to breaks in the sprayed coat and it may be possible that the spray can cannot be emptied completely due to the early exhaust of the propellant gas.

➔ As soon as you have finished spraying **do not operate the can upside down** trying to clean the valve and nozzle. The spray can is equipped with a self-cleaning valve. Upside down operation could cause stained nozzles and subsequently an impairment of serviceability or the loss of propellant gas.

➔ Make sure, the **spray can has room temperature** while using. The gas pressure in the can is adjusted for best spraying results with room temperature. During the storage in a cold storeroom, the gas pressure in the spray can decreases and accordingly the characteristics of spraying can change. Similarly, continued spraying for a long time (e.g. for large areas) can lead to the can's refrigeration and according to this, the gas pressure will decrease. When receiving the spray can in winter by the postman, please let it warm up to room temperature before you start working with it. As well, coating by continued spraying for a long time (e.g. coating of large areas) can lead to cooling the can and in succession to decreasing pressure of the propellant gas within the can. Therefore cover very large areas in several sections or work with two spray cans in turn.

➔ markSolid 114 works with all **marking lasers** which are industry standard and work with a wavelength of 10,6µm (CO_2) or 1064nm (Fiber-, Nd:YAG-Laser). When working with YAG- or fibre lasers choose the „CW" (= **Continuous Wave** resp. frequency = 0 Hz) setting. If CW is not available then start with highest possible frequency and also try slightly defocussed laser beam. In case of doubt please contact your laser device manufacturer.

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How to proceed:

1. The **metal surface** must be clean, dry and free from grease. When indicated, clean with alcohol or acetone.

2. **Shake the aerosol can for an adequate period of time**.
   During a longer period of non-usage, it is possible that the aerosol can's light and heavy contents divide from each other. Sufficient long and intense shaking causes the regeneration of a homogenous suspension. After some seconds of shaking, you will hear the pea in the can for the first time. After this point of time the pea supports the mixing of the contents. **Don't stop the shaking** as soon as you hear the pea in the can for the first time! Shake at least twice as long from this point of time.

3. **Choose the most suitable nozzle**.
   The markSolid 114 aerosol can comes with two spraying nozzles, creating a circular or alternatively an elliptical spray spot. The angle of the elliptical spraying nozzle is infinitely adjustable at 360° for an optimal adjustment to the coating job.

4. **Coat the metal surface**. Take care to hold the can as upright as possible, especially with regard to emptying cans, to make sure that the dip tube at the can's bottom will not stick out of the liquid. When indicated, put the area, which is to be coated in an upright position, to be able to use the can as upright as possible again.

5. **Lead the spray jet over the surface as smooth as possible**. Keep the nozzle pushed while changing direction and pay attention to do this only outside the area which is to be coated.

6. **The coat should be very thin, barely enough to cover the surface**. This is equivalent to approx. 30 µm thickness of the dried layer. Layers which are too thick cause a higher laser energy, thin layers in turn possibly lead to brighter marks. Thicker layers, which have been marked with adjusted laser power can show a higher chemical resistance under several circumstances, yet there is danger that mechanical resistance may be slightly reduced.

7. **Dry the marking material before you begin marking**. Exposed to the air one or two minutes are enough. A warm air blower reduces the drying time to a few seconds.

8. **After marking remove the excess product** with a damp cloth or in water (also ultrasonic cleaning is possible).

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Optimising laser parameters:

For determination of the correct laser parameters the knowledge about some basic contexts is helpful:

- Well thermo conducting metals lead the absorbed laser energy very fast to the inside (e.g. aluminium alloys, brass, copper, …) and therefore afford a higher laser power and/or a reduced marking speed.

- Due to their structures, „refined" surfaces (e.g. chromed, nickel-plated) and even high-alloyed steel grades need a higher energy to achieve a good and permanent result.

- Lacquered surfaces cannot be marked, as the marking material has to be in direct contact with the metal surface. Every "non metallic" coating impedes the marking.

- In general, subsequent context is valid: if the mark is removable, the laser energy has to be increased. Normally the mark will occur darker and more permanent the more the energy increases, until an optimal result is existent. A further increase of application of energy beyond this point may cause a pejoration of the result.

Example stainless steel: With too low laser energy, the mark is removable. More laser energy leads to an enduring mark which will have a greyish look. Only an increase in power leads to a permanent black mark with optimal durability. A further increase of application of energy would cause first bright annealing colours in the marking area, which brighten the mark and let it look brownish. It is possible that annealing colours can change the characteristics of stainless steel, e.g. a higher danger of corrosion.

Examples for laser parameters with CO_2-plotter systems and YAG/Fibre lasers

CO_2-Laser: P= 35 Watt =100%, V= 1.500 mm/sec =100%, f= 1,5"

substrate	*power*	*speed*	*dpi / ppi*
stainless steel 1.4301	90 %	30 %	500
aluminium	100 %	10 %	500
brass	100 %	15 %	500
chrome-plated metal	100 %	10 %	500

YAG/Fibre laser: P= 20W =100%, f= 160 mm, operation mode =CW (Continuous Wave or f= 0Hz)

substrate		*power*	*speed*	*hatch spacing*
stainless steel 1.4301	*)	40 %	300 mm/s	40 µm
stainless steel 1.4301	**)	100 %	600 mm/s	40 µm
aluminium		80 %	125 mm/s	40 µm
brass		90 %	100 mm/s	40 µm
chrome-plated metal		60 %	150 mm/s	40 µm
high-alloyed steel		50 %	200 mm/s	40 µm

*) parameter for blackest marking **) parameter for fastest marking speed

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Systematic approach for adjusting and optimising the laser parameter

For example: for a CO_2-lasers (plotter systems) with approx. 50 Watt and fibre- resp. YAG-lasers in power range approx. 20 Watt to 50 Watt:

STEP 1: Start with approx. 2/3 of laser power and approx. 1/3 of maximum marking speed. If the mark is durable, continue with step 2.
In case of removable marks, increase the laser power to 100 % and repeat the test. If the mark is still removable, you should reduce the marking speed for the next tries significantly, until you receive a durable result.

STEP 2: Determine the values for maximum and minimum marking speed for the adjusted laser power. Use the following approach:
Increase the marking speed initially in bigger, and later in smaller steps as long as either the marking colour is brighter or the mark is removable again. When indicated, reduce the laser power in time to work just below maximum speed.
Now reduce with given laser power the marking speed initially in bigger and later in smaller steps as long as you recognize a pejoration of the result.
This depends on the material, normally the colour changes from black to the brownish or the mark starts to change it's look strongly when examining at different angles of light exposure.
The optimum marking speed (in respect of darkest black and durability) is reached shortly before change happens.

Optimising: Based on this adjustment you can now increase power and speed in small steps as long as your laser marking device's maximum capacity is not exceeded. Possibly you will notice even before that the marking process will not allow any further increase in power or speed.

This manual is a recommendation how a systematic search for the right laser parameters can look like. In fact, some laser marking devices support and simplify with each own functions the determination of optimal parameters. Use the functions which your device supports and receive the optimal result even faster.

Further documents and basic useful information:

- MSDS_markSolid-114.pdf — material safety data sheet
- Laser_Adjustment.pdf — laser adjustment by test grid
- QuickStart_Spray.pdf — three steps to the complete mark

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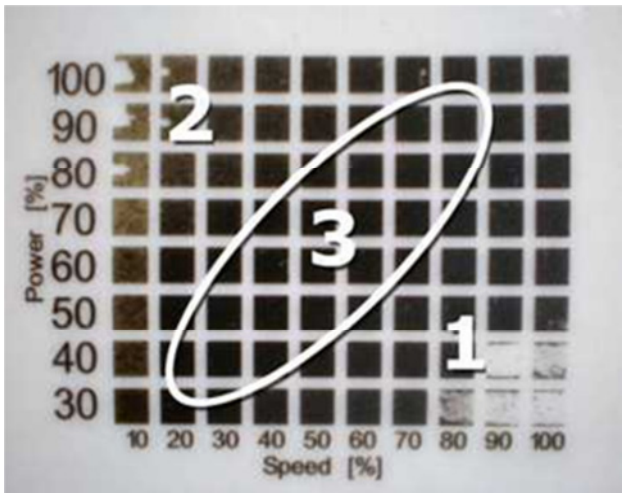
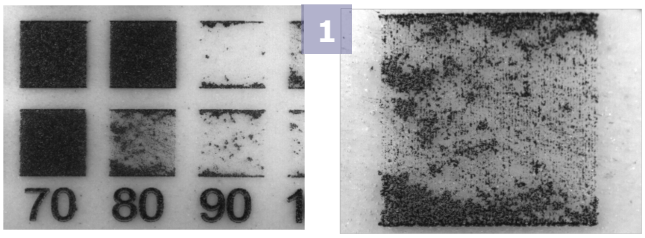
Optimization of laser parameters

The markSolid process is a thermally activated process. The result is a permanent bond of the Laser Marking Material with the surface to be marked.
The process of marking only takes place when a certain amount of temperature is transported by the laser. The result will be a physical and chemical fusion. Too little power leads to the LMM not bonding at all with the surface or only in part **(1)**. Likewise a "too much" of power causes the LMM to be removed and may lead to damage to the substrate surface **(2)**. The working window of good marks **(3)** lies in between.

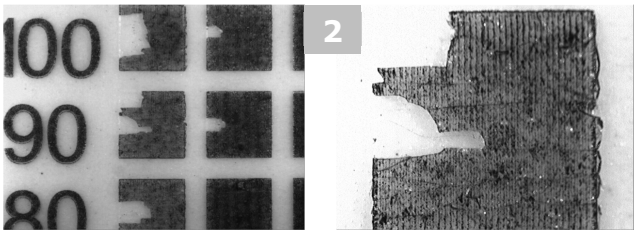


Evaluation of the results

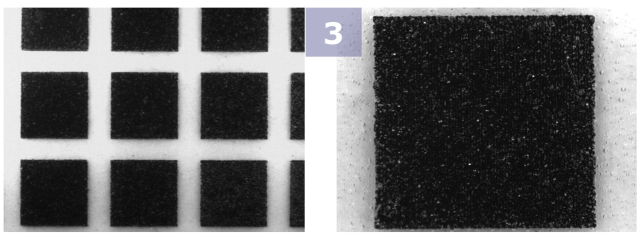
The laser parameters vary from square to square. The depicted test screens show the varying speed processes in the X-axis and the CO_2 laser marker power in the Y-axis.



It is easily recognizable that in the area (**1**) with the lower power and higher speed in process the energy supplied was insufficient. The LMM is not sufficiently fixed to the surface and could partly be removed upon cleaning.



The energy amount is at its best **(2)** when the highest power and lowest speed is applied. The failure of the LMM and damage to the surface of the component is well recognizable in the picture.



The working window for good and permanent marks (**3)** lies in between, with the lines flowing.

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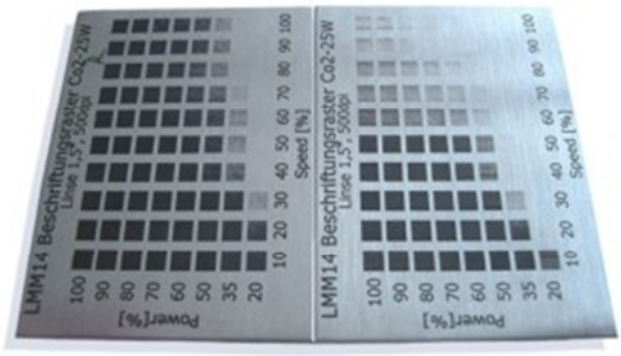
Best durability

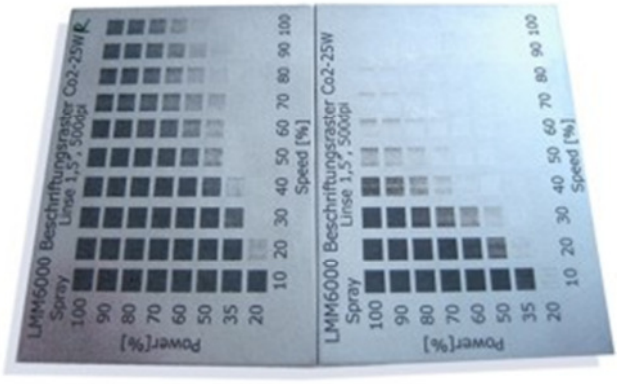
The Laser Marking Materials generally offer a great working window. The width of the usable working area is, however, depending on several factors.

- If the substrate to be marked is a good heat conductor, e.g. aluminium, higher laser energy (less processing speed and/or higher power) is required.

- The more intensive the substrate reacts on the laser wavelength (e.g. glass reacts very sensible to the CO2 laser radiation) the lower the laser energy should be applied. For a good result a carefully and evenly applied thickness of the LMM coating is especially important

- Strong wear and tear of markings remain in proper condition when made with the highest possible energy within the recommended working window. Compared to those, markings are less stress able when produced with lower energy.





Both pictures show 2 stainless steel tags marked with different laser settings:

Left tag is before and right tag is after 1 week exposition to aggressive chemical environment.

Both pictures show a test screen before and after setting out to a chemical reaction. It can well be recognized that the most consistent markings were produced with parameter combinations in the area of lower speed and higher power.

As a rule markings are tried to be made as quickly as possible and normally a parameter combination will be chosen of higher speed in process (and thereby lower energy). However, in order to receive a most resistant marking a parameter combination with a higher energy input should be chosen.

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