GRAFMETAL

**grafmetal.com**
**grafmetal@grafmetal.com**

# User maual of GRAFMETAL Metal Etching Paste

## Scope

Metal Etching Paste is intended to be used for local etching of metals like steel, stainless steel, aluminium and copper alloys. The paste makes the etched surface bright and matte. The change has a permanent character, because the paste removes a small amount of metal from the surface, which yields an effect of matte engraving.

Etching process may be carried out with a mask or without it. Without any mask one may obtain permanent patterns on metals in places of manual application of paste. Using masks makes it possible to manufacture precise engravings. Masks may be cut manually or with dedicated machines, e.g. plotters, cutters or lasers for cutting or engraving.

The paste is suitable for majority of metals, which are not noble metals, however one does not always obtain the same effect. It is then recommended to carry out tests with a similar material and similar mask before working with final parts.

## How to use

1. Read the instructions and warnings. Prepare your workstation: provide ventilation to avoid inhaling fumes and provide hand and eye protection. Paste and its fumes etch metals, so remove any objects that could be damaged. Paste is a hazardous material and should be kept away from children and unauthorized persons.
2. Apply mask to the metal object to be etched, for example, apply mask cut of adhesive foil. If necessary, the sticker can be wiped with a cloth saturated with petroleum ether, so that the etching paste does not run under it. Alternatively, you can coat the object with metal spray paint and engrave the design into it with a laser using 1 or 2 passes as needed. Paste fumes can tarnish the object right next to the application point, so the mask should have adequate margins.
3. Apply the paste to the parts to be etched by using a plastic or wooden spatula or brush. Rub them lightly so that you are sure the entire pattern is wetted with the paste. Make sure that there are no uncovered areas. If you do not use a mask and a brush does not give satisfactory results, it is recommended to use a sharp wooden tool, such as a toothpick or a cut spatula, to apply the paste. Check the degree of coverage of the pattern after a few minutes and correct if necessary.
4. After 10 to 60 minutes, the paste should be rinsed off with water and then wiped dry with a tissue or a cloth. The mask is then removed by e.g. by peeling off the stickers or by washing off the paint with a solvent, after which one obtains the final pattern. For some metals, it may be necessary to extend the etching time or carry out the process more than once. The effect of etching depends on the type of metal and its surface smoothness, so the etching procedure should be refined experimentally.

**Waste treatment:** Small amounts of paste can be flushed with water - calcium present there will bind hazardous substances. Dispose of larger amounts with chalk. Do not introduce into water reservoirs.

**Additional tips for application of masks cut of adhesive foils or tapes**

Cut adhesive foil should be applied to the metal substrate so that no air bubbles remain under it. For large surfaces, you can first spray them with glass cleaner or apply water with dishwashing liquid, then apply the sticker. After that use a squeegee or spatula to remove air bubbles and excess fluid. If liquid under the sticker has been applied, wait until the whole thing is dry and the applied foil is well bonded to the substrate.

**Tips for laser mask making**

If the mask was not made by cutting with a plotter or by hand of adhesive foil (such as vinyl), then it can be made by laser. It is then recommended to choose any of the following methods:

- If metal sheet is coated with a protective foil, then it is possible to burn a pattern in it by either engraving or cutting. If cutting is chosen, then it will be necessary to manually remove pieces of foil inside the contour lines. If one chooses engraving, then it is recommended to clean the metal surface after laser processing with a cloth soaked with a petroleum ether.
- Coat the metal object with spray paint for metals. Wait for the paint to dry. Engrave the desired pattern with a laser, such as a CO2 laser. For diode lasers, remember that the color of the paint should be dark, preferably black. The top layer of the paint is easily removed by the laser, but the deeper layers just near the metal surface are more difficult to burn off, as the metal strongly dissipates heat. It is therefore recommended to carry out more than one pass of the laser. Relatively high power and low pass speeds are recommended. Alternatively, paint residue after laser engraving can also be removed with a cloth saturated with a solvent selected according to paint type.
- Apply fabric-reinforced tape, also known as duct tape, to the metal object. Black tape colour is be recommended for diode lasers. Burn the pattern in the tape by using laser. After engraving the pattern, remove the tape residues from the burned areas by using a cloth soaked with petroleum ether. The tape should be applied to the substrate in such a wayo that no air bubbles remain underneath. This can be done in such a way that you can first spray the substrate with glass cleaner or apply water with dishwashing liquid, then apply the tape, and then use a squeegee or spatula to remove air bubbles and excess fluid. If liquid under the tape was used, wait until the whole thing dries and the applied tape is well bonded to the substrate.
- Apply a vinyl adhesive foil to the metal object, in the case of diode lasers it should be a black film. Burn a pattern in the foil with a laser, using 2 or 3 relatively slow passes at high power. Ensure that no air bubbles remain under the film prior to laser processing by using the notes in the subsection above. CAUTION: Some hydrochloric acid may be formed during the processing of vinyl film, which can be harmful to machine components! Therefore, only occasional laser processing of vinyl film is recommended, only with adequate ventilation.

One can check whether the metal surface is already suitable for the application of etching paste after laser engraving by verification if there are still large amounts of paint, foil, adhesive or tape residues on the burned metal surface. This process can be carried out by using a universal electrical

meter in resistance measurement mode. To do this, one should apply both electrodes of the meter to the areas burned by the laser and measure the resistance. If the resistance is high or even so high that it is impossible to measure, it means that there are still large residues of the mask on the surface of the object, and it is necessary to either repeat the engraving or wash off these residues with a cloth saturated with a suitable solvent. The method with a meter often gives better results than observation with the naked eye, because in the case of some materials (e.g., vinyl foil), even after several laser runs on the surface there are residues of the film, which, however, do not prevent resistance measurement and do not interfere with paste etching. The opposite is true for masking tape or transfer film, where the surface looks clean after laser treatment, but the resistance is high and the etching effects are poor.

**Caution! Paste vapour also have etching properties, therefore the mask should cover the object not just by the pattern to etch, but also further away.**

**Achieving more matte patterns**

If the resulting pattern is not matte enough or not visible enough, the etching time can be increased, the process temperature can be increased or the paste can be applied several times.
The processing parameters depend on the type of metal and its surface finish, in view of which they should be adapted experimentally.

**Cleaning**

After processing, rinse the paste thoroughly with water. If the assumed effect is satisfactory, then you can remove the mask in the form of a sticker or remove the paint acting as a mask with a solvent.

**General safety remarks**

Metal etching paste is a hazardous preparation with corrosive and toxic effects. Eye and skin protection through gloves and safety glasses is required. Ensure good ventilation and do not inhale paste fumes, which are corrosive and harmful to health. Take special care when using paste on heated surfaces.

**The paste may lead to corrosion of metal elements in direct vicinity, therefore it should be used far away from objects that can get damaged.**

**Safety**

Hazard statements: H290 May be corrosive to metals  H302 Harmful if swallowed. H314 Causes severe skin burns and eye damage. H335May cause respiratory irritation.
Precautionary statements: P280 Wear protective gloves/protective clothing/eye protection/face protection P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P305+P351+P338 IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
Contains: sulfuric acid, iron chloride

THE PRODUCT IS INTENDED FOR PROFESSIONAL USE ONLY. THE PRODUCER IS NOT RESPONSIBLE FOR ANY INCORRECT USE THEREOF.

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| Producer:<br>KARWYS<br>Piołunowa 43<br>81-589 Gdynia<br>Poland, European Union<br>Tax ID number: PL9581590886 | Contact information:<br>grafmetal@grafmetal.com<br>+48 575 737 991 |