



Silk Matt Precious Metal Preparations for Direct Screen Printing and Decal Production on Glass

1 General Information

Silk matt decorations need not to be burnished after firing and therefore they are a low-cost alternatives to the conventional burnish gold and burnish platinum decoration.

Heraeus supplies a silk matt gold paste for glass with a precious metal content of 14%.

2 Standard Firing Range

Glass Type	Firing Range	
Soda Lime Glass	520 - 620°C	(940 - 1150°F)
Lead Crystal	480 - 540°C	(890 - 1004°F)

The optimum firing result depends on the firing temperature, on the total firing time, the soak time and not least on the glass type. To achieve an optimized firing result, we therefore recommend the user to check under his own individual conditions.

3 Properties Of The Preparations

The major characteristics of a Heraeus precious metal preparation are determined by its production recipe. From each lot produced, we take a sample and check defined characteristics.

In case of screen printing preparations, before firing, we check the physical properties (e. g. viscosity, thixotropy) and the application properties (e. g. printing and drying properties), compared to a predefined standard. After the firing under defined conditions, we check the optical properties (matt level and colour). Controlling each single production lot assures the highest product quality and lot-to-lot stability.

3.1 Processing

We supply silk matt precious metal preparations for screen printing ready to use. They can be applied without further thinning.

Screen printing pastes have a thixotropic nature in order to reach their printing properties. In some cases, the preparations reach their typical processing viscosity only under mechanical stress, that means under a certain print speed. Thixotropic pastes allow for printing fine lined decorations with a sharp outline.

3.2 Storage

The solid fine distribute particle, deposit during the storage time, therefore it is necessary to stir the products before use.

Also silk matt precious metal products are subject to an ageing process. As a rule, the viscosity increases with the storage time. Therefore, we recommend to use the preparations within 3 months. They should be stored at room temperature (approx. 20°C / 70°F).

The statements concerning our products correspond to our current knowledge and experience. It is the obligation of the purchaser to examine the usefulness of the products in its intended use in each individual case. In order to prevent production losses the user has to test the preparations in connection with every other material being involved in the production process and has to be satisfied that the intended result can be consistently produced.

Storage at approx. 7-14°C / 45-57 °F reduces the increase of viscosity during the storage.

3.3 Consumption

The material consumption depends on the printing parameters (screen fabric, coating, squeegee position, squeegee pressure). Under our conditions, the consumption is approx. 0.15 to 0.30 g / 100 cm².

4 Properties Of Finished Decorations

The main properties of fired precious metal decorations comprise matt level and precious metal tone as well as their resistance.

These properties are influenced by a number of factors. The high quality of the preparation used is an absolute prerequisite for manufacturing high-quality decorations. The quality of a fired decoration, however, derives from the interplay of preparation, application, substrate surface and firing conditions. A variation in one factor – for instance, the firing conditions, has an influence that leads to altered properties of the fired decoration.

We have processed the precious metal preparations under defined conditions. Then we determined the properties of the finished decorations. They must, however, always be checked by the user under his own individual conditions.

4.1 Silver Containing Precious Metal Preparations

To achieve lemonish, light yellow and yellow gold decorations, silver is added to the formulation of precious metal preparations. Silver containing precious metal decorations can change their appearance in the course of time, under certain unfavourable external circumstances. Especially the contact to cardboard boxes, high humidity and high temperature support the reaction of silver to silver sulphide. Therefore, the user must individually check the suitability of a silver containing preparation.

Products with a higher silver content we labeled as "silver containing". We recommend to hermetically package items decorated with precious metal preparation we describe as "silver containing", and to prevent direct contact with cardboard boxes.

5 Application Recommendations

5.1 Basic Information on Products, Screens And Squeegees

- Work in a well-ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C / 68 to 77°F.
- Heraeus supplies precious metal preparations with a viscosity ready for use. In general, thinning is not necessary. In case the pastes have an increased viscosity after a long storage time, the printing properties can be improved with an addition of maximum 5 - 10% of thinner V 170. The thinner has to be stirred in very well. We recommend using a triple roll mill for an optimum homogenisation.
- For printing the silk matt gold paste, a 100-40 polyester screen or a 300 - 350 mesh steel screen should be used.
- For a good printing result, it is important to have a well ground squeegee (hardness: 60-75° shore).

5.2 Production Of A Silk Matt Gold Decoration

- Stir the Silk matt gold paste very well.
- Apply the product to the screen. Apply as much as product that the screen will be "flooded" with one squeegee motion. We recommend to apply not too much paste, because it is better to add during the print procedure fresh paste. Through this procedure the evaporation of the solvent from the precious metal paste during printing will be minimized.
- During short printing breaks (few minutes) the screen should be flooded, to prevent the paste from drying and the blocking the screen machine. During long printing breaks, the screen has to be clean with our screen

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cleaner V 34 before the resumption of printing.

- In general, the precious metal product is printed at first. After drying it is possible to apply additional colours.
- If precious metal products and colours are adjacent the registration of the prints is very important, because incompatibility reactions with the colours are possible (precious metal products react to cadmium containing red colours).
- As screen printing covercoat, we recommend L 406. This film stable, not block resistant standard covercoat with a solids content of approx. 42% is also available as a thixotropic version. Please refer to our product programme and technical information sheets regarding further special screen printing covercoats.
- After drying, the decal can be transferred to the object to be decorated.

5.3 Transfer Of The Decals To The Object To Be Decorated

- The decals to be transferred have to be steeped in water (water temperature 20 to 30°C / 68 to 86°F). Decals can be released faster from the decal paper when the steep water is slightly heated.

In case the steep water is too cold, decals can be released from the decal paper only with difficulty and during transfer of the decal, cracking of the precious metal decoration can occur. If the steep water is too warm, the decals become too soft and are difficult to apply accurately. There is also a tendency for the covercoat film to shrink during drying.

The steep water should be changed regularly. If the steep water is too much polluted with dextrin residues from the decal paper, spots or pin holes may appear after firing.

- The transferred and adjusted decal has to be pressed carefully onto the object with a squeegee. The squeegee should be used from the centre to the edge of the decal, to allow water residues, dextrin residues and air bubbles to escape.
- Afterwards, the surface of the decal should be cleaned with a damp sponge. Dextrin residues on the decal may lead to a bad firing result of the precious metal decoration (spots).
- Before firing, the decorated ware should be dried at room temperature (20 to 22°C / 68 to 72°F) for 16 to 24 hours.

5.4 Firing

- During the heating up phase, first of all the organic components of the preparation burn off. This process is completed at approx. 400°C (750°F). The gold film formed. A constant, slow temperature increase, enough oxygen and sufficient ventilation are decisive for the quality of the fired precious metal decoration.
- The firing profile considerably influences the mechanical and chemical properties of the fired decoration.
- The rate of cooling has no major influence on the quality of the gold decoration, unlike the firing temperature and soak time. However, the firing process should not be stopped too abruptly after the soak time. If the rate of cooling is too fast, there may be a danger of damaging the article (cracks and broken glass).

6 Frequent Faults, Their Causes And Ways Of Avoiding Them

Fault	Possible cause	Remedy
the fired precious metal decoration is too glossy	the preparation was not stirred enough	stir the preparation before use
	the layer of the product is too thin	use a 100-40 polyester screen / 300 to 350 mesh steel screen
the fired precious metal decoration is too dull	the layer of the product is too thick	use a 100-40 polyester screen / 300 to 350 mesh steel screen
	the viscosity of the product is too high	thinning of the product with V 170
stripes in the printing precious metal decoration	the squeegee shows possibly scratches	squeegee exchange, or grind off the old one
squashed printing format	the squeegee has not enough pressure or is worn out (rounded off)	squeegee exchange, or grind off the old one
spots, pin holes, matt firing result	Objects were soiled by dust, finger marks or water drops	clean the object before decorating
	glue residues under or on the decal	frequent changing of the steep water, wipe off the decal with a damp sponge
	problems in the kiln such as: <ul style="list-style-type: none"> reduced atmosphere in kiln insufficient ventilation heat increase is too fast during critical phase between 200-400°C (390-750°F) too many objects in the kiln 	<ul style="list-style-type: none"> increase air addition improvement ventilation reduce the heating speed reduce the number of objects in the kiln
precious metal flakes off during firing	contamination of the substrate surface causes chip offs after firing	clean the substrate before application
	water residues under the decal	careful pressing of the decal by the squeegee and drying
	the layer of the product is too thick	reduce the layer of the product
cracking of the decoration	decal extension was too great	do not extend the decal so much.
	steeping water is too cold and / or transfer of the decal onto a cold object	steeping water should be warmed up a little.
low mechanical resistance of the precious metal decoration	firing temperature was too low	increase firing temperature
	printed layer was too thin	use a 100-40 polyester screen / 350 to 400 mesh steel screen

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W. C. Heraeus

Business Unit Precious Colours
Heraeusstraße 12-14
D-63450 Hanau
Phone: +49 (0) 6181 35 4420
Fax: +49 (0) 6181 35 9637
E-mail: preciouscolours@heraeus.com
Internet: www.heraeus-preciouscolours.com

7 Silk Matt Gold Preparations For Direct Screen Printing On Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes
yellow	MGP 2042	14%	●			-
yellow	MG 5100	12%	●			satin-matt surface finish
rosé	MGP 2139	10%	●			-

new!

8 Silk Matt Gold Preparation For Decals On Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes*
yellow	MGP 2042	14%	●			-
reddish yellow	MG 5167	10%	●			-

new!

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9 Silk Matt Platinum Preparation For Direct Screen Printing On Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes
white platinum	MG 5102	11%	● Glass			-

new!

10 Silk Matt Platinum Preparation For Decals On Glass

Colour	Product	Precious Metal Content	Glass	Lead Crystal (firing temperature max. 540°C/1004°F)	Coated Glass	Notes
white platinum	MPP 4016	12%	● Glass			-

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