



Bright Precious Metal Preparations for Direct Screen Printing and Decals on Tiles

1 General Information

Heraeus supplies bright gold and bright platinum preparations for direct screen printing on tiles with different precious metal contents. Depending on the precious metal content and the thickness of the precious metal application, a precious metal film of approx. 0.1 µm forms after firing.

2 Standard Firing Range

760 – 1000°C / 1400-1832°F

The firing result depends on the firing temperature, on the total firing time, the soak time and not least on the properties of the glaze. To achieve an optimized firing result, we therefore recommend that firing tests are made under the user's own individual conditions.

3 Properties

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.

Before firing screen printing preparations we check the physical properties (eg. viscosity, thixotropy) and also the application properties (eg. printing and drying properties), compared to a predefined standard. After firing under defined conditions, we check the optical properties (gloss level and colour). Checking each single production lot assures the highest product quality and lot-to-lot stability.

3.1 Processing

We supply bright precious metal preparations for direct screen printing ready for 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

Since the precious metals in bright precious metal products are organically bound, there is no sedimentation. Bright precious metal products are also subject to an ageing process. As a rule, the preparation's viscosity will increase when stored for a longer period of time. Therefore, we recommend using the preparations within 12 months. They should be stored at room temperature (approx. 20°C / 70°F). Storage at approx. 7-14°C / 45-57°F reduces the increase in viscosity during 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. 0.2 to 0.3g / 100 cm².

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.

4 Properties Of Finished Decorations

The main properties of fired bright precious metal decorations are their brilliance and precious metal tone, dishwasher resistance and resistance to mechanical and chemical attack.

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 interaction of the preparation, the application, the substrate surface and the firing conditions. A variation in only one factor – for instance, the firing conditions - will alter the properties of the fired decoration.

We have processed the bright metal preparations under defined conditions. Then we determined the properties of the finished decorations. The following data indicates which quality features can be achieved with finished decorations manufactured with bright precious metal preparations. They must, however, always be checked by the user under his own individual conditions.

4.1 Mechanical and chemical Resistance

The mechanical resistance of a precious metal decoration is influenced by the chemical composition of the used precious metal preparation and also by the substrate surface, the firing conditions and the layer thickness of the fired precious metal layer.

Precious metal decorations manufactured with Heraeus precious metal preparations for direct screen printing on tiles (s. items 7 and 8) have good abrasion resistance as well as good resistance to chemical attack from commercial detergents.

5 Application Recommendations

5.1 Conditions required for good results

- Work in a well-ventilated room. Good printing conditions exist at a room temperature of 20 to 25°C / 68 to 77°F.
- Make sure that the surface of the object to be decorated is clean and dry. Dust, fingerprints and water condensation can affect the decoration while firing, and therefore have to be removed before application.
- Take care that the object to be decorated is not taken from a cold store into a warm workshop. A fine condensation film may occur. Result: Faults (pinholes) in the fired precious metal decoration. Allow enough time so that they can adjust to the temperature of the workshop.

5.2 Basic information on Products, Screens and Squeegees

- 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 by the addition of a maximum of 10 % thinner V 170 or V 180. The thinner has to be stirred in very well. We recommend using a triple roll mill for optimum homogenisation.
- For printing the bright gold and bright platinum paste, a 120-34 to 140-34 polyester screen or a 350 – 400 mesh steel screen should be used.
- For good printing results, it is important to have a well sharpened squeegee (hardness: 60-75° shore).

5.3 Firing

- During the first heating phase the organic components of the preparation burn off. This process is completed at approx. 400°C (750°F). The precious metal film is 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 decorated articles are cooled down too quickly, there is a danger the glaze cracking.

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5.4 Cleaning the Screen and Squeegee

Screens and squeegees have to be cleaned directly after printing. We recommend the use of our screen cleaner V 34. This special screen cleaner prevents the clogging of the fine screen structure and prolongs the lifespan of the screen.

6. Frequent Faults, Their Causes And Ways Of Avoiding Them

Fault	Possible Cause	Remedy
stripes in the printed 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, firing faults	Objects were soiled by dust, finger marks or water drops before printing.	Clean the object before decorating.
	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 300-400°C (572-750°F) too many objects in the kiln 	<ul style="list-style-type: none"> increase air addition improvement of the ventilation reduce the heating speed reduce the number of objects in the kiln
Precious metal flakes off after firing.	Objects were soiled by dust, finger marks or water drops before printing.	Clean the object before decorating.
	The layer of the product is too thick	Reduce the layer of the product
Low mechanical resistance of the precious metal decoration.	Too low firing temperature	Increase the firing temperature
	Printed layer was too thin.	Steeping water should be warmed up a little. It is of great importance to warm up the object to be decorated e.g. with a infrared radiator
low mechanical resistance of the precious metal decoration	Too low firing temperature	Increase the firing temperature
	The layer of the product is too thin	Best results achieved with 120-34 to 140-34 Polyester screens / 350 to 400 mesh steel screens.
Fine pinholes.	Moisture on the objects before decoration is applied leads to firing faults (pinholes).	Give the ware enough time to adjust to the temperature of the decoration shop and so allow the possible condensation film to evaporate.

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