



## 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 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.

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.

### 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 cm<sup>2</sup>.

## 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).

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## 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.

## 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
Streaks in the printed precious metal decoration.	The squeegee is possibly scratched.	Exchange or sharpen the squeegee.
Squashed print.	The squeegee is not sharp or it is worn out (rounded edges).	Exchange or sharpen the squeegee.
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"> <li>• reduction atmosphere in kiln.</li> <li>• insufficient ventilation.</li> <li>• heat increase is too fast during critical phase between 300-400°C (570-750°F).</li> <li>• too many objects in the kiln.</li> </ul>	<ul style="list-style-type: none"> <li>• increase air addition.</li> <li>• improve ventilation.</li> <li>• reduce the heating speed.</li> <li>• reduce the number of objects in the kiln.</li> </ul>
Precious metal flakes off after firing.	Objects were soiled by dust, finger marks or water drops before printing.	Clean the object before decorating.
	Printed layer was too thick.	Reduce thickness of the printed layer.
Low mechanical resistance of the precious metal decoration.	Firing temperature was too low.	Increase the firing temperature.
	Printed layer was 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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## 7 Bright Gold Preparations

Colour	Product	Vetrosa	UV-curing	high firing temperatures approx. 900-1000°C/1650-1830°F	Notes	
light yellow	GZ 5324				lemon yellow firing result	<i>new!</i>
yellow	GGP 2450				also suitable for fast firing, wide firing range	
yellow	GGP 2519/UV		●		-	
yellow	GGP 2603				normal firing, well-tried standard preparation, excellent printing properties, excellent mechanical and chemical resistance	
yellow	GGP 2456	●			special product for the decoration of tiles, excellent printing properties, excellent mechanical and chemical resistance	
yellow	GGP 2608				normal firing, well-tried standard preparation, excellent printing properties, excellent mechanical and chemical resistance	
yellow	GGP 2457				normal firing, well-priced special preparation for tiles, wide firing range, excellent printing properties, excellent mechanical and chemical resistance	
yellow	GGP 2621				most reasonable preparation	
yellow	GGP 2573				wide firing range up to 920°C/1688°F, excellent printing properties, excellent mechanical and chemical resistance	
yellow	GGP 2346				wide firing range up to 920°C/1688°F, excellent printing properties, excellent mechanical and chemical resistance	
yellow	TGG0158A				-	<i>new!</i>
reddish yellow	GG 5310				excellent mechanical resistance, firing range up to 940°C/1720°F	<i>new!</i>
reddish yellow	TGG0157A10				-	<i>new!</i>
reddish yellow	GGP 2385/HT		●		high temperature bright gold paste, for soft tile glazes, can be fired next to vetrosa in one fire	
reddish yellow	GGP 2617	●			also suitable for fast firing, wide firing range up to 1000°C/1830°F, excellent mechanical and chemical resistance	

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## 8 Bright Platinum Preparations

Colour	Product	Vetrosa	high firing temperatures, approx. 900-1000°C/1650-1830°F	Notes	
white	GPP 4601			also suitable for fast firing, wide firing range, also for decals	
white platinum	GP 5550 A			-	<i>new!</i>
white platinum	GP 5311			-	<i>new!</i>
white platinum	GP 5315			-	<i>new!</i>
white platinum	TGP0050A			-	<i>new!</i>
platinum	GPP 4386/HT		●	high temperature bright platinum paste, for soft tile glazes, can be fired next to vetrosa in one fire, excellent mechanical resistance	
platinum	GPP 4331	●		well-priced preparation, excellent printing properties, excellent mechanical and chemical resistance	
platinum	GPP 4328	●		normal firing	
platinum	GPP 4332			most reasonable preparation	
platinum	GPP 7000 D			-	

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