# Bright Precious Metal Preparations for Brush Application and for Spraying on Porcelain, Bone China, Earthenware and Tiles

## 1 General Information

Heraeus supplies bright precious metal preparations for porcelain, Bone China, earthenware and tiles with different precious metal contents. Depending on the precious metal content and the thickness of the precious metal application, a gold film of approx. 0.05 – 0.2 $\mu$m forms after firing.

## 2 Standard Firing Range

| Substrate Type | Firing Range |
|---|---|
| • Porcelain | 780 - 880°C (1436 - 1616°F) |
| • Bone China | 750 - 880°C (1380 - 1616°F) |
| • Vitreous China | 750 - 850°C (1380 - 1560°F) |
| • Earthenware | 650 - 740°C (1200 - 1365°F) |
| • Tiles | 760 - 900°C (1400 – 1650°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 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.

We check the physical properties (e. g. viscosity) and also the application properties (e.g. brushability) of our precious metal preparations for brush application against a predefined standard before firing. After the firing under defined conditions, we check the optical properties (gloss level and colour). Controlling each single production lot assures the highest product quality and lot-to-lot stability. The mayor characteristics of a Heraeus precious metal preparation are determined by its production recipe. From each produced lot we take a sample and check defined characteristics.

### 3.1 Processing

We deliver bright precious metal preparations for brush application ready to use. They can be applied without further thinning and distinguish themselves by their excellent application properties and outline. Storage

Since bright precious metal products contain precious metal organically bound, there is no sedimentation. Nevertheless, a minor sedimentation may occur in case of thin fluid preparations. Should there be any sedimentation, it must not be shaken and remains in the bottle.

Also bright precious metal products are subject to an ageing process. As a rule, the viscosity increases with the



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storage time. Therefore, we recommend to use the preparations within 9 months. They should be stored at room temperature (c. 20°C / 70°F).

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

### 3.2 Consumption

The material consumption depends on the thickness of the applied precious metal layer. 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 bright precious metal decorations comprise 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 interplay of preparation, application, substrate surface and firing conditions. A variation in only one factor – for instance, the firing conditions, has an immediate influence that leads to altered properties of the fired decoration.

We have processed the bright precious metal preparations under defined conditions. Then we determined the properties of the finished decorations. The following data indicate achievable quality features for the 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 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.

### 4.2 Dishwasher Durability

All details as to whether decorations are dishwasher durable are to be regarded as approximate values, as test results vary widely according to the type of dishwasher, washing programme, washing-up detergent, water quality and firing conditions.

Heraeus tests whether finished decorations are dishwasher durable, roughly following the test-washing programme of the Technical Standards Committee for Material Testing (Fachnormenausschuss Materialprüfung) in a Miele continuous dishwasher.

If a decoration withstands 500 washing cycles essentially without damage, we designate it as dishwasher durable. If it withstands 1000 washing cycles, we designate it as dishwasher resistant.

The user must test the required properties under his own conditions.

### 4.3 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. To exclude any risk, we recommend using yellow red gold preparations.





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## 5 Application Recommendations

### 5.1 Conditions Required For Good Results

- Work in a well-ventilated room. Good printing conditions occur at a room temperature of 20 to 25°C.
- 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.
- Take care that the object to be decorated is not taken from a cold store into a warm shop. A fine condensation film may occur, which is not visible for the naked eye. Result: Firing disturbance (pinholes) in the fired precious metal decoration! Allow enough time for the material to adjust to the decoration room temperature.

### 5.2 Application Information

- Do not shake the bright precious metal preparations prior to use.
- Draw from the bottle only as much as you can consume within 15 or 30 minutes and close the bottle. Consider that the solvent continuously evaporates in air and therefore the viscosity slowly increases.
- Apply the preparation in a moderate layer thickness onto the object to be decorated. A too thin layer influences the mechanical, chemical and optical properties of the fired decoration. In extreme cases, it can lead to a reddish colour of the surface without any gold character. A too thick layer may lead to cracking, blistering, or to a matt surface.
- In case the preparation is used for spraying, thinning with about 30% thinner V 35, V 16 or V 18 is required.

### 5.3 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 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. In case the decorated article cools down too quickly, there is a danger of cracks in the glaze.





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

| Fault | Possible Cause | Remedy |
|---|---|---|
| blurred contours, running precious metal | too much thinning of the product | leave the bottle open for a while, so that some of the solvent can evaporate |
| | the thinner was too fat or drying too slowly | leave the bottle open for a while, so that some of the solvent can evaporate |
| | too much organic fumes in the furnace | reduce the number of objects in the furnace |
| preparation shows bad application | viscosity is too high after long application or long storage | thinning of the product with V 35, V 16 or V 18 |
| spots, firing disturbance | contamination as dust, fingerprints or water condensation | Carefully clean the object before decorating |
| | problems in the kiln such as:<br>• reduced atmosphere in kiln<br>• insufficient ventilation<br>• heat increase is too fast during critical phase between 200-400°C (390-750°F)<br>• too many objects in the kiln | <br>• increase air addition<br>• improve ventilation<br>• reduce the heating speed<br>• reduce the number of the objects in the kiln |
| Precious metal chips offs during firing | contamination of the surface causes chip off | clean the substrate before decorating |
| | the layer of the product it too thick | reduce layer of the product |
| low mechanical resistance of the precious metal decoration | firing temperature is too low | increase firing temperature |
| | layer of the product is too thin | increase layer thickness |
| fine pinholes | pinholes can be released by moisture on the surface of the decorated object. Taking objects from a cool store into a warm shop leads to invisible condensation on the surface. | allow enough time for the ware to reach shop temperature, so that the condensation has time to evaporate. |





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