High Temperature Precious Metal Preparations for Brush Application on Porcelain

1 General Information

High temperature precious metal preparations are especially developed for inglaze fast firing. They contain precious metal in dispersed form, adhesive agents and resin solutions as film formers.

Decorations produced with high temperature precious metal preparations result in dull, brown surfaces. Only after burnishing with a glass fibre brush, sand or similar auxiliary material the typical silk matt brilliance arises.

Besides this optical effect, burnishing leads to compression of the precious metal particles in the surface and therefore to a distinctive improvement of the abrasion resistance. As a rule, decorations produced with burnish preparations are more abrasion resistant than bright precious metal decorations.

Heraeus supplies high temperature precious metal preparations for the decoration of porcelain. Depending on the precious metal content and the thickness of the layer, a precious metal film of approx. 0.3 up to 1.0 µm forms after firing.

2 Firing Range

Substrate type	Firing range for fast firing
Porcelain	1180°C (2156°F) - 1250°C (2282°F)

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 high temperature precious metal preparations for brush application we check the viscosity, the brushing characteristics, sharp outline of the applied material as well as the colour shade and the optical appearance of the fired decoration in comparison to the “standard” of this product. Controlling each single production lot assures the highest product quality and lot-to-lot stability.

3.1 Processing

We deliver high temperature precious preparations ready to use. They can be applied without thinning. Before use the preparations need to be shaken.

3.2 Storage

Also high temperature precious metal preparations are subject to an ageing process. As a rule, the viscosity increases with the storage time. High temperature precious metal preparations have a settlement of the matting agent, therefore the materials need to be shaken before they are used. Therefore, we recommend to use the preparations within 6 months. They should be stored at room

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temperature (approx. 20°C / 70°F).

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

3.3 Consumption

The material consumption depends on the thickness of the applied precious metal layer. Under our conditions, the consumption is approx. 0.3 to 0.4 g /100 cm².

4 Properties of Finished Decorations

The main properties of fired high temperature precious metal decorations comprise matt level and precious metal tone, as well as 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 one factor – for instance, the firing conditions, has an influence that leads to altered properties of the fired decoration.

We have processed high temperature 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 high temperature precious metal preparations. However, the user must always test the products under his own individual conditions.

4.1 Mechanical Resistance

(see information in our product overview)

4.2 Dishwasher Resistance/-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.

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 / 66-77°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.
- 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. This results in faults (eg. pinholes) in the fired precious metal decoration. Allow enough time for the material to adjust to the decoration room temperature.

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5.2 Application Information

- High temperature precious metal preparations have a settlement of the matting agent, therefore the materials need to be shaken before they are used.
- Heraeus supplies high temperature precious metal preparations with a viscosity ready to use. They can be used without thinning, In some cases thinning cannot be avoided:
    - After long processing
    - During decoration of large areas and
    - By brushing

  In these cases we recommend adding 5 -15% of thinner V 35 or V 39.
- Draw from the bottle only as much as you can consume in 15 or 30 minutes and close the bottle immediately. Consider that the solvent evaporates in air and therefore the viscosity increases.
- Apply the preparation in a moderate thick layer onto the object to be decorated. A too thin layer influences the chemical and mechanical resistance 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 can lead to cracking or to a matt surface.
- Ensure dust free surroundings during the application process and during drying. A wet surface is attractive to dust. After the drying, fire the decorated article as soon as possible.

5.3 Firing

- During the heating up phase, first of all the organic components burn off. This process is complete at approx. 400°C (750°F). The gold film is formed. A constant slow increase in temperature, enough oxygen and sufficient ventilation are decisive for the quality of the fired precious metal decoration.
- The maximum firing temperature and the soak time have an important influence on the adhesive strength of the fired decoration. As a rough rule of thumb: The higher the firing temperature the better the adhesive strength.

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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
	too much organic fume in the kiln	reduce the number of objects in the kiln
preparation shows bad application condition	viscosity is too high after long application or long storage	thinning of the product with V35 or V 39
spots, firing disturbance	contaminations as dust, finger marks or water condensation	clean the substrate before decorating
	problems in the kiln • furnace atmosphere reduction • insufficient ventilation • too quick heat up in the critical phase between 200-400°C (390-750°F) • too many objects in the furnace	• increase air addition • increase ventilation • reduce the heating speed • reduce the number of objects in the kiln
precious metal is cracking after firing	contamination of the surface causes cracking	clean the substrate before decorating
	printed layer of the product was too thick	reduce thickness of applied film
	too much thinning of the product	less thinning of the product
low mechanical resistance of the precious metal decoration	too low firing temperature	increase the firing temperature
	the layer of the product is too thin	increase the layer thickness of the precious metal decoration
fine pinholes	pin holes can be caused by moisture on the surface of the decorated object. Taking objects from a cool store into a warm shop causes invisible condensation on the surface.	allow enough time for the ware to reach shop temperature

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7 High temperature bright Precious Metal preparations for brush application on porcelain

	Colour	Product	Precious Metal Content	ASTM-resistant	microwave-resistant	Sanitary Ware	Notes*
	yellow	PG 822		☐	☐	☐	firing range 1200-1250°C / 2190-2280°F
	white platinum	SG 5946		☐	☐	☐	dishwasher resistant

* All liquid high temperature precious metal preparations need to be shaken before use

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