bright palladium paste

GPP 4605 H for decal printing

Heraeus Precious Coatings is a global manufacturer of precious metal decoration products for ceramics and glass. Heraeus profits from over 100 years experience in ceramic and glass decoration designs, which has always made the department a pioneer in the development of precious metal colours. Modern precious metal preparations have to meet high demands on different types of substrates – such as on porcelain, tiles, drinking glasses, flacons and bottles. Decorations have to achieve good mechanical and chemical resistance such as dishwasher durability.The products supplied by Heraeus Precious Coatings include: Bright gold and platinum products, silk-matt gold and platinum products, burnish gold and platinum products, lusters and metallo-organic preparations for technical use.

1 General information

GPP 4605 H is special bright palladium decal paste for the decoration of porcelain. The material fires out with a whitish platinum colour shade. With its moderate metal contant it is a lower cost material well known in the industry. The material is also suitable to be used in the “Heraeus-Matt-Gold-System” as well as in the Etching-Imitation- System for decals. For more detailed information, please check our Technical Information Sheets for these decoration systems.

2 Standard firing range

Substrate	Firing range [°C]
porcelain	780-880

The firing result depends on the firing temperature, the total cycle time, the soak time as well as the glaze chemistry of the substrate decorated. To achieve an optimal firing result, we recommend firing tests under the users own individual conditions.

Directly to the product:

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3 Properties of the product

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 decal pastes we check the physical properties (e. g. viscosity, thixotropy) and the printing properties compared to a predefined standard. After firing under standard firing conditions, we check the metal colour shade and the adhesion to the substrate. Controlling each single production lot assures the highest product quality and lot-to-lot consistency.

3.1 Processing

We supply decal pastes ready to use. GPP 4605 H has a thixotropic nature, means the typical printing viscosity is reached at certain printing speed, when the thixotropy is temporarily broken. The applied material hardens instantly and assure a sharp outline of the print.

3.2 Storage

Printing pastes are subject to an ageing process. Therefore, we recommend using the material within 9 months. The material should be stored at room temperature (20°C). Cool storage – but no freezing – has a positive impact on the shelf life.

3.3 Consumption

The material consumption depends on the thickness of the applied precious metal layer. Under our conditions, the consumption is approx. 0,15 to 0,30g/100 cm^2.

4 Properties of finished decorations

The properties of finished decorations are influenced by a number of factors which interact with each other: The precious metal preparation used, possible bordering colours, the quality of the print, the material deposit, the quality of the decal paper, the correct application of the decal and of course the firing conditions.

The main properties of fired bright precious metal decorations comprise brilliance and precious metal tone, dishwasher resistance, scratch resistance and resistance against chemical attack.

We have processed the bright precious metal preparations under standard test 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 Dishwasher resistance

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.

Test decorations prepared with GPP 4605 H proofed to be dishwasher durable.

4.2 Abrasion resistance

Decorations with GPP 4605 H showed a reasonable scratch resistance.

4.3 Oxidation resistance

Under unfavourable conditions silver containing precious metal decorations can tarnish in the course of time. Especially the contact to cardboard boxes, high humidity and high temperature support the reaction of silver to silver sulphide. GPP 4605 H does not contain silver and therefore is not at risk to tarnish.

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5 Application of the material

5.1 Preparation for the decoration

Work in a well-ventilated room. The room temperature should be between 20-25°C with a relative humidity of 60-70%.

5.2 Preparation of the substrate to be decorated

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 substrate to adjust to the decoration room temperature.

5.3 Production of decals

- Heraeus supplies decal pastes with a viscosity ready to use. In general, thinning is not necessary. In case the paste has 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 optimal homogenisation.
- Apply an appropriate quantity of the material onto the screen, so that the screen can be flooded with one squeegee motion. We recommend applying not too much paste. It is better to add fresh paste during the printing procedure. This way, the viscosity increase caused by the evaporation of the solvent from the precious metal paste during printing can be minimized.
- During shorter printing breaks (a few minutes), the screen should be continuously flooded, to prevent the paste from drying and blocking of the screen. During longer breaks, the screen has to be cleaned with our screen cleaner V 34 before the resumption of printing.
- As a general rule, the precious metal paste is printed at first. For the printing of the decal paste we recommend the usage of a 120-34 to 140-34 polyester screen. For a good printing result a well sharpened squeegee is required. Shore hardness 60-75 shore.
- After the drying of the precious metal paste, additional colours might be applied. If the precious metal material borders colours, the registration of the prints is very important because an incompatibility reaction with the bordering colour is possible. Precious metals preparations typically react sensitive to bordering cadmium containing colours most of all reds.
- The complete motif needs to be covered with layer of covercoat. For the printing of the covercoat we recommend to use a 32HD polyester screen.
- After drying, the decal can be transferred to the object to be decorated.

5.4 Transfer of the decal

- The decals are soaked in slightly warmed water (20 to 30°C). If the water is too cold the decals do not release well from the decal paper. Is the water too warm, the decals might get too soft.
- It is important to change with water quite regularly.
- It is essential to remove the water between decal and substrate by a careful squeeging of the decal. Trapped water could fire off explosively and create defects in the metal film. Additionally we recommend cleaning the surface of the applied decal with a sponge, in order to remove all dextrin rests on top of the decal.
- The decorated ware should be dried before firing at room temperature (20 to 22°C) for 16 to 24 hours.

5.5 Firing

- During the first heating phase the organic components of the preparation burn off. This process is completed at approx. 400°C. 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. If the rate of cooling is too fast, there may be a danger of damaging the article (cracks and broken glass).

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6 Typical defects, root causes and countermeasures

Defect	Possible Cause	Counter measure
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 warn out (rounded off)	Squeegee exchange, or grind off the old one
Blurred contours, running precious metal	Too much thinning of the product	Leave the pot open for a while, so that some of the solvent can evaporate
Spots	Contamination as dust, finger marks or water drops	Clean the object before decorating
Pin holes	Glue residues under or on the decal	Frequent changing of the steep water. Wipe off the decal with a damp sponge
Matt firing result	Problems in the kiln such as: a) Reduced atmosphere in kiln b) Insufficient ventilation c) Heat increase is too fast during the critical phase between 200- 400°C d) Too many objects in the kiln	a) Increase air addition b) Improvement of the ventilation c) Reduce the heating speed d) Reduce the number of objects in the kiln
Precious metal is cracking during firing	a) Contamination of the substrate surface causes cracking b) Water residues under the decal c) The layer of the product is too thick	a) Clean the substrate before application b) Careful pressing of the decal by the squeegee and drying c) Reduce the layer of the product

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Defect	Possible Cause	Counter measure
Cracking of the decoration	a) Decal extension was too high b) Steeping water is too cold and / or transfer of the decal onto a cold object	a) Do no extend the decal so much. If necessary, use an elastic screen printing covercoat and take care of the following information b) 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	a) Too low firing temperature b) The layer of the preparation is too thin	a) Increase the firing temperature b) Use a 120-34 to 140-34 polyester screen / 350 to 425 mesh steel screen
Gold decoration has shrinked / retreated from a bordering colour.	Cd containing colour might be directly bordering or even overlapping.	Ideally Cd-colours should not directly border precious metals. If this cannot be prevented, please keep a certain distance or print a non-Cd-colour in between metal and Cd-colour

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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.