



Decoration System One Fire Etching Imitation for Porcelain

1 General Information

In an original etching decoration first parts of the substrate glaze need to be removed by the use of hydrofluoric acid. In the second step the precious metal gets applied. At the lower parts, where the glaze has been removed, the bright precious metal shows a silk matt appearance, on top of the glaze a bright appearance.

The Heraeus One-Fire-Etching-Imitation-System allows to produce a similar optical effect without the need to work with aggressive acid. It is a decal system consisting of a special white underlay which creates a matt surface, plus a bright relief for a raised effect and the special bright metal paste on top.

In this Product Information Sheet we introduce the Heraeus One-Fire-Etching-Imitation-System for Porcelain.

2 Standard Firing Range

| | |
|-----------|--------------|
| Substrate | Firing range |
| Porcelain | 800 – 820°C |
| | |

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.

3 Properties of the preparations

The product composition and the production process determine the major product characteristics of the components of the decoration system. Testing each production lot guarantees a constant product quality.

With regard to the bright precious metal pastes of the system we regularly check the viscosity, the printing characteristics, the outline of printed test decorations as well as the precious metal colour shade and the brightness of the decoration after firing on a defined test substrate.

In case of the special underlay and the relief, we test eg. the grain sizes and the grain size distribution of each produced lot, the behaviour of the materials when pasted and the fired result in a test firing.



3.1 Processing

Heraeus bright precious metal pastes are supplied ready to use. They can be processed without any thinning. The testing of each produced lot assures the consistent quality of our pastes.

The special underlay and the bright relief need to be pasted with the recommended pasting ratios and should be homogenized with a three-roll-mill.

3.2 Storage

Precious metal decal pastes

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.

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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.

Special underlay and bright relief

The special underlay and the relief are both colour powders which basically have no storage limitation. One needs to take care that they are stored in dry environment. Exposure to humidity can lead to problems during the pasting with the special medium.

Special medium

The special medium Nr. 238/3 should be used within 9 months time. The material should be stored at room temperature (20°C).

3.3 Consumption of precious metal paste

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 cm².

4 Properties of finished decorations

Major characteristics of an imitation etch decoration are the brilliance of the metal film, the metal colour shade, the resistance of the decoration in dishwashing machines as well as the mechanical and chemical resistance.

These characteristics are determined by a number of factors. High quality products and the fine matching of the components (underlay, relief and precious metal preparation) are necessary to achieve a good fired result. Apart from the components the application, the glaze of the substrate and the firing conditions also play an important role. The variation of one factor, for example the firing conditions, can significantly affect the fired result.

We have tested the etch imitation system introduced in this technical information sheet on different Bone China substrates. However, the diversity of different types of glaze and firing conditions worldwide does not allow simple general statements about the achievable decoration quality. All mentioned test results relate to our specific tests only. The system needs to be tested under the user's own individual conditions.

4.1 Dishwasher resistance

All details as to whether decorations are dishwasher resistant or 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. To avoid defective production, the user should test the colours in connection with materials involved in further processing and determine whether the desired dishwasher proof or resistant decorations are achieved.

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

In our tests, etching imitation decorations reached the level of dishwasher durability.

4.2 Abrasion resistance

Test decorations showed a good mechanical resistance. Tests under ones own individual conditions are essential.

5 Application recommendations

5.1 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

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condensation can affect the decoration while firing.

Take care that the objects to be decorated are not taken from a cold store into a warm shop. A fine condensation film may occur, which is not visible to the naked eye. This results in firing disturbance (pinholes) in the fired precious metal decoration. Allow enough time so that they can adjust to the decoration room temperature.

5.2 Production of decals

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

Pasting of the special underlay H 55080 with special medium Nr. 238/3 in a ratio of 100:50 parts by weight (underlay : medium). The paste needs to be well homogenized with a triple roll mill.

Printing of the underlay paste with a 130-34 to 150-31 polyester screen.

Drying over night at room temperature (20°C)

Pasting of the special bright relief H 55090 with special medium Nr. 238/3 in a ration of 100:55 parts by weight (bright relief : medium). The paste needs to be homogenized with a triple roll mill.

Printing of the bright relief paste with a 230 to 300 mesh stainless steel screen or a 54-64 to 77-48 polyester screen.

Drying over night at room temperature (20°C).

Printing of the bright precious metal paste with a 120-34 polyester screen. See the list of suitable bright gold and bright palladium / platinum pastes.

Drying over night at room temperature (20°C)

Printing of covercoat with a 32-120 polyester screen.

Drying over night at room temperature (20°C)

The finished etching imitation decals should be used within four weeks.

Important note! Do not print special underlay + relief decals on stock. It is not possible to store decals printed with a special underlay/relief in order to print the bright gold paste at a later time. The complete decal needs to be freshly printed as explained above.

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

5.3 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 squeegeeing 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.

5.4 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.

6 Typical defects, root causes and counter measures

| Defect | Possible Cause | Countermeasure |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Inhomogeneous surface | Layer of the printed special underlay is too thin. | We recommend printing the underlay with a 130-34 to 150-31 polyester screen. |
| Dull, matt fired precious metal layer on top of the underlay. | Print of the underlay is too thin. | We recommend printing the underlay with a 130-34 to 150-31 polyester screen. |
| Cracking of the decoration. | Underlay was pasted with too little medium. | We recommend a mixing ratio of 100:50 parts by weight (underlay : medium). |
| | Water residue and air bubbles could not escape. | Decal should be carefully squeegeed onto the substrate all water rests removed. |
| Firing disturbances, dark spots in the fired decoration. | Underlay was pasted with too much medium. | We recommend a mixing ratio of 100:50 parts by weight (underlay : medium). |
| | Decal was not cleaned after application. | Clean surface of the decal with a damp sponge. |
| Screen structure can be seen in the decoration. | Underlay was not dry enough before the print of the relief. | Drying over night at room temperature (20°C). |
| The bright relief chips off. | The bright relief was printed too thin. | We recommend printing the bright relief with a 230 to 300 mesh stainless steel screen. |
| | Wrong medium was used. | Use medium Nr. 238/3. |
| Pinholes in the bright relief. Partial chip offs. | The bright relief was pasted with too little special medium. | We recommend a mixing ratio of 100:55 parts by weight (bright relief : special medium). |
| No sharp outline. Brightness and brilliance missing. | The relief was pasted with too much medium. | We recommend a mixing ratio of 100 : 55 parts by weight (bright relief : special medium). |
| Screen meshes visible. Pinholes. | The relief was not dry enough when overprinted with the bright precious metal paste. | We recommend drying over night, before the metal paste will be applied. |
| Non-optimal fired metal film. | Precious metal deposit is too thin. | We recommend printing the precious metal paste with a 120-34 polyester screen. |
| Matt and spotty fired metal film after firing. | Print of the precious metal paste is too thick. | We recommend printing the precious metal paste with a 120-34 polyester screen. |
| | Decal was not cleaned after application. | Clean surface of the decal with a damp sponge. |
| Screen structure visible. Non-optimal fired precious metal film. | Precious metal layer had been still to humid when overprinted with covercoat. | We recommend drying over night at room temperature (20°C). |
| Cracks, firing disturbances | Surface of the decal paper is too rough. | We recommend the usage of a decal paper with a smooth surface. |

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| Defect | Possible Cause | Countermeasure |
|--------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cracks. | Firing temperature is too high and/or firing cycle is too long. | In our tests we achieved good fired results with firing temperatures of 800-820°C. A good fired result depends on the combination of the glaze of the article to be decorated, the firing temperature and the firing cycle. Firing test under ones owns individual firing conditions are essential. |
| | Underlay and relief paste was too old when both were processed. | Please generally work with freshly pasted underlay and relief paste. |
| Bad adhesion, dull and matt precious metal decoration. | Firing temperature is too low and / or firing cycle is too short. | In our tests we achieved good fired results with firing temperatures of 800-820°C. A good fired result depends on the combination of the glaze of the article to be decorated, the firing temperature and the firing cycle. Firing test under ones own individual firing conditions are essential. |

7 Products

| Product | Appearance | Major characteristics |
|-----------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bright gold and bright platinum pastes | | |
| GGP 2538-10% | light yellow | Good detergent durability, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GGP 2538-12% | light yellow | Good detergent durability, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GGP 2536-10% H | yellow | Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GGP 2555-12% H | yellow | Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GGP 2556-10% H | yellow | Good detergent durability, good ASTM resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System as well as for the gold under flux (F080802) system. |
| GGP 3022D-12% H | yellow | Good detergent durability, good ASTM and Calgonite resistance, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System, oxidation insensitive |
| GPP 1240 H | platinum | Bright platinum paste, dishwasher durability at higher fast firing, oxidation insensitive, suitable for the Heraeus Matt Gold System and the Etching Imitation System |
| GPP 4520 H | platinum white | Bright palladium paste, good detergent resistance, suitable for Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GPP 4522 H | platinum white | Bright palladium paste, slightly lower percentage version compared with GPP 4520 H, good detergent resistance, suitable for Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GPP 4605 H | platinum white | Bright palladium paste, good detergent resistance, suitable for Heraeus Matt Gold System and the One Fire Etching Imitation System |
| GPP 4308 H | platinum yellow | Bright platinum paste for bone china decoration, good detergent durability, good Cascade resistance, oxidation insensitive, suitable for the Heraeus Matt Gold System and the One Fire Etching Imitation System |
| Matt underlay and bright relief | | |
| H 55080 | matt white | Lead free matt underlay for the One Fire Etching Imitation System for porcelain |
| H 55090 | bright relief | Lead free bright relief for the One Fire Etching Imitation System for porcelain |
| Special medium | | |
| Nr. 238/3 | transparent | Special medium for the pasting of the matt underlay and the bright relief for the One Fire Etching Imitation System |

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