

Bright Gold Decorations Do Not Have To Be Expensive!

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The sight of objects decorated with gold has always left a fascinating impression on people. This is particularly true for the decoration of glass and ceramics, which can look back on a long tradition. All along artistic decorations have been applied with diverse decorating media using a variety of techniques. High-quality precious metal decorations are costly and raise the value of simple white ware not only optically. The most impressive kind of ceramic decoration is undoubtedly a gold decoration. That this can still be affordable, even in times of ever increasing precious metal prices, is the subject of this article.

Deciding on a Bright Gold Decoration

No matter whether plates or cups, tiles, drinking glass, bottle or flacon: bright gold decorations convey the feeling of life-style and refined luxury. Precious metals are increasingly making their return on ceramics and glass. Glass and ceramic decorators have recognized this trend and are using precious metals to increase the value of their products. In this way, for example, a manufacturer of decal prints with precious metal decorations can achieve a higher net profit per decal sheet on the market, as

opposed to without. If large amounts of bright gold are used in the production of decorations, then the consumption must be appropriately controlled. Decorating products containing precious metals must give a high yield and have an acceptable price. If these requirements can be brought together, then the decision to produce bright gold decorations falls easily.

Bright Gold Decorations Have Their Value

Bright gold preparations consist of soluble precious metal compounds or precious metal powders, organometallic bonding agents, as well as resins and solvents. They contain not only gold but also a variety of other precious metals such as silver, platinum, palladium and rhodium. These precious metal additives are important for the preparation, as they influence the colour shade and durability of the fired decoration. The price level of bright gold is therefore dependent upon the precious metals employed. These are traded world-wide on the precious metal market. As gold is the main component of a bright gold preparation, the total price is determined fundamentally by the trade value of gold. Due to the economically tur-



Fig. 1 Gold price

bulent times and the need many people have to invest in stable assets such as gold, an extensive run on gold is taking place. Consequently this causes an increase in demand. The continual increase of the gold price over the last two years is the unavoidable consequence.

This forces the manufacturers of decorations to more efficient production methods, for example fully automated decoration with decals or even the application by direct printing. As a top address in the world of precious metals, Heraeus has responded to this and developed innovative new bright gold products, with reduced precious metal content, that have been adapted to meet the high standards set by the consumer and not least the increasing price of gold. At the same time they have not lost their expressiveness and brilliance. By using optimized raw and intermediate products, a lower gold content has been achieved. The intelligent combination of precious metal alloys in the bright gold has made it possible not only to reduce costs by the moder-

An example calculation

With 10 g of a 10 % bright gold, approximately 320 plates (24 cm diameter) can be hand-decorated with a 2.5 cm wide band. A 7 % bright gold paste would, in comparison to a 10 % paste, save up to 30 g of fine gold per kilogramme. With a 7 % bright gold paste the gold content has been reduced by 30 %.

Cost calculation for gold band

Gold price per 01.04.09:	22,33 EUR/g
Product used:	Bright Gold with 10 % precious metal content
Consumption per plate:	0,031 g
Cost per plate:	69 Cents
Gold price per 01.04.09:	22,33 EUR/g
Product used:	Bright Gold with 7 % precious metal content
Consumption per plate:	0,022 g
Cost per plate:	49 Cents



Fig. 2 Final product

Tab. 1
Product used per
100 cm² [g]

	Brush Application	Screen-Print (120-34 Polyester Screen)	Screen-Print (77-48 Polyester Screen)
Bright Gold 12 %	0,16-0,20	0,28	
Bright Gold 10 %	0,16-0,20	0,28	
Bright Gold 8 %	0,16-0,20	0,28	
Burnish Gold 30 %	0,30-0,40		0,40
Burnish Gold 16 %	0,30-0,40		0,40

Product /Bright gold paste (selected Heraeus specialized products)	Dishwasher Test			ASTM Test			Calgonite Test		
	820°C/45'/10* Electric kiln	860°C/45'/10* Electric kiln	880°C/20'/5* Gas kiln	820°C/45'/10* Electric kiln	860°C/45'/10* Electric kiln	880°C/20'/5* Gas kiln	820°C/45'/10* Electric kiln	860°C/45'/10* Electric kiln	880°C/20'/5* Gas kiln
A (Precious metal content: 12 %)	●	●	●	●	●	●	●	●	●
B (Precious metal content: 10 %)	●	●	●	●	●	●	○	●	●
C (Precious metal content: 7-9 %)	○	○	○	○	●	○	○	●	○

Tab. 2
Durability test
results

- : resistant
- : durable
- ◆: not durable

Dishwasher Durability

- Substrate: Porcelain
 - Test programme: Fachnormenausschuss für Materialprüfung (FNM)
 - Dishwasher: Miele Long-Time Test Dishwasher
- As per Heraeus criteria:
1000 cycles = dishwasher resistant ●, 500 cycles = dishwasher durable ○

ASTM-Test

- Substrate: Porcelain
 - 0,3 % Soda solution
 - Temperature: 98 °C
 - Abrasion test after 2, 4 und 6 hours in the test solution
- No attack after 6 hours = ●, no attack after 4 hours = ○

Calgonite-Test

- Substrate: Porcelain
 - 4 % Calgonite detergent solution
 - Temperature: 77 °C
 - Abrasion test after 4 x 24 hours in the test solution
- No attack after 96 hours = ●, no attack after 24 hours = ○

ate use of precious metals but also to increase their durability.

Consumption Figures for Precious Metal Preparations – A Practical View

Considering, for example, a plate decorated with bright gold, the question arises as to how much gold is required for the decoration. This would be a very small amount, as the layer thickness is in the nanometre range. The layer thickness and consumption of the precious metals depends upon the decorating method. These are diverse. Decorating products can be applied by brush, spraying, screen or pad print-

ing methods. In the glass and ceramic industry screen printing is one of the favoured methods when it comes to producing high quality decorations in large quantities. Depending on the printing parameters (screen mesh, squeegee setting and squeegee pressure), the consumption of the bright gold paste is approximately 0.2 – 0.3 g / 100 cm². When printing precious metal pastes, practice has shown that the best results are achieved with 120-34 to 140-34 polyester screens or 350 to 400 mesh steel screens. A well sharpened squeegee (60 – 75° Shore) is also important for a good print. The pressure with which the squeegee is applied depends upon the rheological character of the

paste and the technical aspects of the printing process. Hence, the thickness of the precious metal on the ceramic substrate is approximately 0.05 – 0.10 µm (i.e. 0.00005 – 0.0001 mm) and depends upon the preparation and the application method. A lower precious metal thickness and less consumption are the target.

Referring to the example calculation, for each plate the cost saving is 20 Cents. This shows how the expenditure for each plate can be reduced effectively by the use of a bright gold with lower precious metal content. Considering the relatively low expenditure required for both bright golds, the sales price of a porcelain plate decorated with bright gold is, in comparison, much higher.

A Study of the Dishwasher Durability of Precious Metal Preparations

It is not sufficient to produce economically and create an aesthetically flawless impression. Precious metal decorations have to meet much higher demands. They must stand up to permanent every-day use. They have to be scratch and abrasion resistant, dishwasher durable or microwave proof, and must not lose their opacity, colour shade or intensity. Presented below are the current precious metal preparations from the Heraeus product range, in particular their improved durability under the three main test methods. These tests and their results depend upon the type of dishwasher, the dishwasher programme, the detergent, the water hardness and the process conditions. In these tests a decal was produced with a 130-34 polyester screen, applied to porcelain plates and fired under various conditions.

The table shows clearly that the bright gold decorations A and B have the highest adhesion and that the adhesion decreases with decreasing gold content in the decoration, but durability is still guaranteed. Evident is the dependency shown by the durability on the various firing conditions. The bright gold decoration C not only shows good durability when fired at 860 °C in an electric kiln and in a gas kiln, but also has good resistance when fired in an electric kiln. It is also clear that the decorations A and B have better resistance results than C, when fast-fired. Under suitable firing

conditions, good results can be achieved with bright gold decoration C. Recognizable is the fact that the firing conditions can have a decisive influence on the quality of a bright gold decoration.

Despite the rule that resistance is dependent on the precious metal content, it is still possible to achieve good durability with low percentage bright gold if the firing conditions are good and excellent precious metal quality is used. The choice of a suitable bright gold is also dependent on the intended use. A bright gold decoration on a wall tile does

not need to achieve a good result in a dishwasher test, whereas a decoration on a porcelain set does.

It is recognizable that gold decorations with a low gold content can be used selectively for suitable requirements. With the correct choice of Heraeus product for the suitable application conditions, low percentage bright gold can be used in decorations without a loss in quality.

Result

Bright gold decorations do not need to be expensive! Extremely thin lay-

ers in the nanometre range require a low consumption of precious metal for each end product. The example calculation given above makes this clear. Even the increasing price for precious metals has only a minimal effect. A large increase in value can be achieved with a small investment. The use of high quality, low percentage Heraeus precious metal preparations offers a good alternative, which can achieve acceptable results under ideal firing conditions, when it comes to durability. Decorating with bright gold is worthwhile and the specified allocation concerning the intended use makes it affordable.