Heraeus

Lustres for Direct Screen Printing and Decals for Glass, Porcelain, Bone China, Earthenware and Tiles

1 General Information

Lustres are based on metallic compounds thinned with organic solvents. After firing, they form a very thin layer (less than 0.1 µm).

Typical characteristics of lustres are their brilliance as well as their metallic iridescent brightness which occurs after firing on smooth substrates. The lustre loses its iridescent effect on matt surfaces and appears matt.

Lustres are suitable for the decoration of glass, porcelain, bone china, earthenware and tiles.

2 Firing Range

480-630°C / 896-1166°F	for glass and lead-crystal.
650-900°C / 1202-1652°F	for porcelain, bone china, earthenware and tiles.

3 Precious Metal Content

Lustres contain less than 6 % precious metal or are precious metal free. Furthermore, they are lead and cadmium free.

4 Properties

4.1 Mechanical Resistance

The mechanical resistance of lustres does not achieve the same standard as most ceramic colours and precious metal preparations because the formed lustre film is very thin. Therefore, we recommend that customers carry out tests under their own conditions to receive the required resistances of decorations made with lustres.

4.2 Application Properties

We deliver lustre preparations ready for use. They can be applied without thinning.

Screen printing pastes have a thixotropic nature in order to reach their printing properties. In some cases, the preparations reach their typical processing viscosity only under mechanical stress, that means under a certain print speed. Thixotropic pastes allow for printing fine lined decorations with a sharp outline.

4.3 UV-Curing

UV-cureable lustre pastes contain reactive components that harden when exposed to UV light. The decoration is dry and ready to be printed over in only a fraction of a second.

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UV-curable lustre pastes can be cured with mercury high pressure lamps with approx. 800-1000 W/cm. With this, the lustres can be cured at a belt speed of approx. 5-10 m/min within 1-2 seconds.

Particularly fast UV-curing can be achieved by arranging 2-3 UV lamps in parallel. Longer curing times can be easily achieved.

4.4 Storage

Lustres should be stored at room temperature (approx. 20℃ / 68℉). We recommend using the preparation s within 6 months.

4.5 Consumption

The material consumption depends on the printing parameters (screen fabric, coating, squeegee position, squeegee pressure).

4.6 Colour Deviation

The quality of a fired decoration derives from the interaction of the preparation, the application, the substrate surface and the firing conditions. With lustres, these influencing factors may cause significant deviations in the colour after firing.

When using lustre pastes for the decoration of ceramic tiles, siginificant deviations in colour may occur depending on the glaze used.

On principle, we recommend that printing and firing tests are made under the user's own individual conditions.

5 Processing

5.1 Basic Information on Products, Screens and Squeegees

- Work in a well-ventilated room. Good printing conditions exist at a room temperature of 20 to 25℃ (68 to 77℉) and a relative humidity of 60 to 70 %.
- Heraeus supplies lustre preparations with a viscosity ready for use. In general, thinning is not necessary. In case the pastes have an increased viscosity after a long storage time, the printing properties can be improved with an addition of a maximum 5 – 10 % thinner V 170. The thinner has to be stirred in very well. We recommend using a triple roll mill for optimum homogenisation.
- To decrease the colour intensity of the lusters they can be mixed with the colourless lustre pastes N 471/SI or N 471/SD. Normally there is no change in the colour tone, and quite often the adhesion is increased.
- For printing the lustre paste, a 150-34 polyester screen (for pastel shades) or a 90-48 polyester screen (for strong colour shades) or a 350 to 400 mesh steel screen should be used.
- With multi-coloured lustre decorations no more than two layers should lie ontop of each other. In this case we recomend using a 130-34 polyester screen. Too thickly applied layers tend to roll or flake off during firing.
- For good printing results, it is important to have a well sharpened squeegee (hardness: 60-75° shore).

5.2 Production of Decals

- Apply an appropriate quantity of the preparation onto the screen, so that the screen is „flooded" with one squeegee motion. At the same time, adding too much paste should be avoided - it is better to add fresh paste during the printing procedure. In this way, the viscosity increase, caused by the evaporation of solvents from the 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 the screen. During longer breaks, the screen has to be cleaned. Our screen cleaner V 34 is best suited for this.

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- Generally, lustre pastes are printed first. After drying, additional decoration colours can be applied.
- The lustre pastes are generally compatible with bordering ceramic colours or precious metal preparations. It should be noted, however, that if lustres containing precious metals come in contact with light, particularly white colours, a blue to purple discolouration may occur. To separate lustre pastes from white enamel we recommend White H 44000.
- As screen printing covercoat, we recommend L 406, L 407 or L 408. We recommend the use of a 32-120 polyester screen.
- The lustre pastes Green N338/SI, Orange N 651/SI, Aurora 497/SI, Brown N504/SI, Salmon N395/SI and Black N508/D/SI are exceptions to the rule and require the isolating covercoat L141/4. To print the isolating layer we recommend a 130-34 polyester screen. Please refer to our product programme and technical information sheets regarding further special screen printing covercoats.
- After drying, the decal can be transferred to the object to be decorated.

5.3 Transfering Decals to the Object to be Decorated

- The decals to be transferred have to be steeped in water (water temperature 20 to 30°C / 68 to 86°F). Decals can be released faster from the decal paper when the steep water is slightly heated.

  If the steep water is too cold it will be difficult to release the decals from the paper, and there is the danger of the decoration “cracking”. If the steep water is too warm the decals become too soft and are difficult to apply accurately. There is also a tendency for the covercoat film to shrink during drying.

  The steep water should be changed regularly. If the steep water is polluted with too much dextrin residues from the decal paper, spots or pin holes may appear after firing.
- The transferred and adjusted decal has to be pressed carefully onto the object with a squeegee. The squeegee should be used from the centre to the edge of the decal, to allow water residues, dextrine residues and air bubbles to escape.
- Afterwards, the surface of the decal should be cleaned with a damp sponge. Dextrin residues on the decal may lead to faults in the fired precious metal decoration (stains).
- The decorated ware should be dried at room temperature (20 to 22°C / 68 to 72°F) for 16 to 24 hours b efore firing.

5.4 Firing the Decals

- During the first heating phase the organic components of the decals burn off. This process is completed at approx. 400°C (750°F). The lustre 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. Cooling down the decorated article too quickly can cause cracks in the glaze.

5.5 Miscibility

Lustre pastes can be mixed with each other. However, unpredictable colour changes may occur, especially if lustres containing precious metals are mixed with lustres free of precious metals. We do not recommend mixing orange lustres with brown lustres, as this results in dirty colour shades.

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5.6 Cleaning the Screen and Squeegee

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

6 Frequent Faults, Their Causes and Ways of Avoiding Them

Fault	Possible Cause	Remedy
Streaks in the printed lustre decoration.	The squeegee is possibly scratched.	Exchange or sharpen the squeegee.
Squashed print.	Incorrect gap between screen and substrate.	Adjust gap between screen and substrate.
Spots, pin holes, matt firing result.	Objects were soiled by dust, finger marks or water drops before printing.	Clean the object before decorating.
	Problems in the kiln such as: • reduction atmosphere in kiln. • insufficient ventilation. • heat increase is too fast during critical phase between 200-400°C (390-750°F). • too many objects in the kiln.	 • increase air addition. • improve ventilation. • reduce the heating speed. • reduce the number of objects in the kiln.
Blurred outline after lustre has been fired (spreading or running).	Too many objects in kiln.	Reduce the number of objects in the kiln.
Lustre flakes off during firing.	Printed layer was too thick.	Reduce thickness of applied film.
Fine pinholes.	Moisture on the objects before decoration is applied leads to firing faults (pinholes).	Give the ware enough time to adjust to the temperature of the decoration shop and so allow the possible condensation film to evaporate.
Low mechanical resistance of the precious metal decoration.	Firing temperature was too low.	Increase the firing temperature.

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7 Lustres for Direct Screen Printing and Decals on Glass

	Number of Colour	Name of colour	contains precious metal	lead free	cadmium free	Notes
	N 631/SI	White		●	●	-
	N 472/SI	Iris		●	●	-
	LU 9301/SI	Silvery Iris		●	●	-
	N 497A/SI	Reddish orange		●	●	-
	LU 9704/SI	Red	●	●	●	-
	N 496/SI	Carmine	●	●	●	-
	N 488/SI	Light blue	●	●	●	-
	N 338/SI	Green	●	●	●	-
	N 493A/SI	Goldamber		●	●	-
	LU 9800/SI	Black	●	●	●	-

Some lustre preparations can be dishwasher durable (depends on firing conditions, substrate etc.). This must, however, always be checked by the user under his own individual conditions.

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8 Lustres for Direct Screen Printing and Decals on Porcelain, Bone China and Tiles

	Number of Colour	Name of colour	contains precious metal	lead free	cadmium free	Notes
	N 631/SI	White		●	●	-
	N 472/SI	Iris		●	●	-
	LU 9301/SI	Silvery Iris		●	●	-
	N 633/SI	Yellow		●	●	-
	N 650/1/SI	Orange		●	●	-
	N 497 A/SI	Reddish orange		●	●	-
	N 495/SI	Ruby	●	●	●	-
	N 496/SI	Carmine	●	●	●	-
	N 012/F/SI	Pink	●	●	●	-
	N 499/SI	Violet	●	●	●	-
	LU 9901/SI	Amethyst	●	●	●	-
	N 486/1/SI	Dark blue	●	●	●	-
	N 488/SI	Light blue	●	●	●	-
	N 338/SI	Green	●	●	●	-
	N 518/SI	Green	●	●	●	-
	N 502/SI	Green		●	●	-
	N 493A/SI	Beige		●	●	-
	N 504/SI	Brown		●	●	-
	N 620/SI	Brown		●	●	-
	ST 26/SI	Copper	●	●	●	-
	N 543/SI	Light grey	●	●	●	-
	N 681/SI	Grey	●	●	●	-
	N 608/SI	Platinum	●	●	●	Platinum lustre
	LU 9800/SI	Black	●	●	●	-
	N 508 D/SI	Black	●	●	●	-

If the user intends to use the lustres for the decoration of tiles, this must be checked under his own indidividual conditions due to different compositions of glaze.

Ruby lustres are prone to gel. Therefore, they should not be stored longer than 3 months.

Some lustre preparations can be dishwasher durable (depends on firing conditions, substrate etc.). This must, however, always be checked by the user under his own individual conditions.

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