

Technical Information

GL15

Products for Sanitaryware

In this technical information leaflet we present our products for the use on sanitary objects. The mentioned products resemble only a limited selection from our range of glazes, frits, and stable colour stains.

Colour stains for the sanitaryware industry must meet specific requirements. Usually they are fired several hours at a temperature higher than 1200 °C, and have to remain true, constant, and specific in colour. They must also be capable of being fired a second time at high temperature without deterioration of colour and surface. This enables a repair or decorating firing. All colour stains from our InstantColor® range for stoneware are subject to intense quality control procedures and of course they fulfil all requirements mentioned above.

Detailed information regarding InstantColor® stains can be found in the brochure FK05 „InstantColor® - Stains for the Stoneware Industry“. Additionally, we offer effect granules for high firing temperatures (Technical Information GL09). Both leaflets are available upon request.

In case of questions to our products and their application, please call our technical service department.

Frits for sanitaryware

For optimization of sanitaryware glazes, we offer a selection of frits which cause the following effects:

- lower melting temperature
- improved gloss of the glaze surface
- prevention of pinholes, hair cracks, and other glaze defects
- improved colour development when colour stains are used (the stains have to be generally suitable for the glaze)

The frits in table 1 on the next page may be added to the glaze in quantities from 1 % to 30 %, depending on the type of frit and on the glaze.

The frits 90 255 E and 90 5692 E are especially suitable for the use as repair frits in a re-firing step.

Ready-to-use glazes

Our product range includes five glazes from glossy transparent to glossy or matt opaque (see table 2). They are suitable for firing in a gas kiln as well as in an electrical kiln.

The firing temperature of our sanitary glazes ranges from 1160 °C to 1260 °C. The thermal expansion is adjusted to the majority of sanitary bodies.

Table 1: Lead free frits for modification of sanitary glazes / repair frits*

Frit	Components	C.T.E. (*10 ⁻⁷ 1/K)	BS (°C)	HBT (°C)	Application	Addition
90 161 M	CaO, Al ₂ O ₃ , SiO ₂ , ZrO ₂ , B ₂ O ₃ , K ₂ O, Na ₂ O	66	775	920	lowering the melting point; repair frit	1 – 15 weight-%
90 167 M	Na ₂ O, K ₂ O, CaO, Al ₂ O ₃ , SiO ₂ , B ₂ O ₃	150	645	740	correction of chips	1 – 8 weight-%
90 255 E	CaO, Al ₂ O ₃ , SiO ₂ , B ₂ O ₃ , BaO	40	910	1280	correction of hair cracks	1 – 10 weight-%
90 368 M	CaO, B ₂ O ₃ , Al ₂ O ₃ , SiO ₂ , Na ₂ O, MgO	69	830	1080	avoiding glaze defects	10 – 30 weight-%
90 5692 E	CaO, Al ₂ O ₃ , SiO ₂ , B ₂ O ₃ , K ₂ O	55	865	1050	avoiding glaze defects; lowering the melting temperature; repair frit	1 – 15 weight-%
99 046 M	ZnO, ZrO ₂ , CaO, Al ₂ O ₃ , SiO ₂ , B ₂ O ₃ , K ₂ O, Na ₂ O, MgO	70	1020	1150	zinc-zircon frit	1 – 15 weight-%

Table 2: Lead free ready-to-use glazes for sanitaryware*

Glaze	Temperature range (°C)	C.T.E. (*10 ⁻⁷ 1/K)	Tg (°C)	BS (°C)	Application	Appearance
49-BCS 97 ¹	1200-1250	58	720	830	can be milled with additives or just stirred	glossy opaque
49-BCS 78 ¹	1160-1230	61	670	805	can be milled with additives or just stirred	matt opaque
40-TRS 140 ¹	1170-1220	65	705	830	can be milled with additives or just stirred	glossy transparent
40-VTRS115	1180-1230	60	675	770	can be milled with additives or just stirred	glossy transparent
40 581 E	1190-1260	58	719	1160	should only be stirred; milling is not recommended	glossy transparent

¹H phrase 412

C.T.E.: linear coefficient of thermal expansion

BS: beginning of softening

Tg: transformation temperature

HBT: half-ball temperature

Particle size: M = medium, E = extra fine

*Lead free: PbO<0.5%. These products are technically lead free. In the production of these materials, we do not use raw materials with lead as a main or minor constituent. However, this does not exclude lead as trace constituent. Our production process is designed to avoid contamination with lead containing products. Chemical analysis show PbO contents significantly below 0.5 %, in general.

Fig. 1: InstantColor® colour samples in transparent glaze A

While every attempt has been made to reproduce colours exactly, the samples printed here may differ slightly from the finished ceramic products.

The glaze compositions used for these examples are listed in table 5.

Each InstantColor® stain must be used according to the parameters stipulated on its accompanying technical

data sheet. Please refer to these sheets for full information.

The chemical composition of some stains makes them unsuitable for use in all glaze systems. Such cases are indicated by ○ in the chart above. Well suitable combinations are marked with ●.

Table 3: InstantColor® stoneware stains composition, crystal structure and firing conditions

Pigment	System	Colour Shade	Crystal Structure	Tmax/°C	Sieve Residue (>32 µm)	Firing Conditions
219 946	Co-Cr-Al	Chrome Green	Spinel	1400	<0,1 %	ox./red.
229 942	Zr-V-Si	Turquoise Blue	Zircon	1350	<0,1 %	ox./slightly red.
229 944	Co-Al	Cobalt Blue	Spinel	1450	<0,1 %	ox./red.
229 946	Co-Si	Cobalt Blue	Olivine	1450	<0,1 %	ox./red.
239 942	Zr-Si-Cd-S-Se	Brilliant Orange	Zircon	1350	<5,0 %	ox.
239 944	Zr-V	Havanna	Baddeleyite	1400	<0,1 %	ox./red.
239 946	Zr-Pr-Si	Intense Yellow	Zircon	1250	<0,1 %	ox.
239 947	Zr-Si-Cd-S	Yellow	Zircon	1350	<5,0 %	ox.
249 942	Co-Cr-Fe-Ni	Black	Spinel	1300	<0,1 %	ox.
259 943	Sn-Sb-V	Neutral Grey	Rutile/ Cassiterite	1300	<0,1 %	ox.
259 969 ¹	Zr-Si-Co-Ni	Zircon Grey	Zircon	1350	<0,1 %	ox./slightly red.
269 946	Zn-Al-Cr-Fe	Biscuit	Spinel	1300	<0,1 %	ox.
269 952	Zn-Cr-Fe	Wood Brown	Spinel	1300	<0,1 %	ox.
279 941	Ca-Sn-Si-Cr	Rose	Sphene	1250	<0,1 %	ox.
279 944	Zr-Si-Cd-S-Se	Intense Red	Zircon	1350	<5,0 %	ox.
279 946	Zr-Fe-Si	Coral	Zircon	1250	<0,1 %	ox.

¹ GHS symbol 08, 09, H phrases 315, 317, 334, 341, 350i, 360D, 372, 411

Fig. 2: InstantColor® colour samples in opaque glazes B, C or D



While every attempt has been made to reproduce colours exactly, the samples printed here may differ slightly from the finished ceramic products.

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Table 4: Glaze system compatibility

Pigment	R ₂ O	MgO	CaO	ZnO	PbO	SnO ₂	B ₂ O ₃	ZrO ₂	Colour addition for colour examples	
									transparent glaze	opaque glaze
219 946		●		●		●			2 % in A	2 % in B
229 942	●				●			○	5 % in A	2 % in B
229 944				○					2 % in A	2 % in B
229 946				○					2 % in A	2 % in B
239 942	●		○	○	○		○		5 % in A	2 % in B
239 944			●	●	●		●		5 % in A	2 % in B
239 946	●				●			○	5 % in A	2 % in B
239 947	●		○	○	○		○		5 % in A	2 % in B
249 942									5 % in A	2 % in C
259 943									5 % in A	2 % in B
259 969 ¹				●	●			○	5 % in A	2 % in B
269 946				○				○	5 % in A	5 % in D
269 952				○				○	5 % in A	5 % in D
279 941			○	●	○	○	●		10 % in A	2 % in B
279 944	●		○	○	○		○		5 % in A	5 % in C
279 946	●				●			○	5 % in A	2 % in B

¹ GHS symbol 08, 09, H phrases 315, 317, 334, 341, 350i, 360D, 372, 411

○: well suitable combinations

●: unsuitable combinations

Table 5: Glaze composition for colour examples

Glaze	A	B	C	D
SiO ₂	64,7	61,7	65,3	60,7
Al ₂ O ₃	13,9	10,9	10,0	13,1
ZrO ₂	-	8,4	8,1	6,0
CaO	10,4	11,8	10,3	9,8
BaO	3,4	-	1,7	3,2
ZnO	3,4	-	-	3,2
K ₂ O	2,2	0,8	2,1	2,1
Na ₂ O	1,0	4,5	1,6	0,9
MgO	0,8	1,9	0,9	0,8
B ₂ O ₃	0,2	-	-	0,2

Colour examples with InstantColor® stains

All standard colour shades can be matched easily by mixing the basic colours of our InstantColor® range. Famous standard colours from different regions are created by using the following recipes.

These recipes have to be adjusted to the glaze to match the exact colour shade. While every attempt has been made to reproduce colours exactly, the colour samples shown here may differ slightly from fired ceramic products.

Magnolia *matt*

100 g glaze
0.10 g 259 969¹
0.40 g 279 944

4.00 g aluminium oxide
6.00 g zircon

Crocus *matt*

100 g glaze
0.10 g 229 944
0.10 g 259 969¹

4.00 g aluminium oxide
8.00 g zircon

Ebony *matt*

100 g glaze
3.40 g 229 946
8.00 g 249 942

8.00 g dolomite
2.80 g aluminium oxide

Capri *glossy*

100 g glaze
0.40 g 229 942
0.30 g 259 969¹

4.50 g zircon

Manhattan *glossy*

100 g glaze
0.10 g 229 942
0.60 g 259 969¹
0.50 g 279 946

8.30 g zircon

Pergamon *glossy*

100 g glaze
0.10 g 239 944
0.10 g 259 969¹
0.10 g 279 946

4.00 g zircon

Bahama Beige *glossy*

100 g glaze
0.35 g 239 946
0.45 g 259 969¹
0.80 g 279 946

6.00 g zircon

Edelweiss *glossy*

100 g glaze
0.05 g 229 944

8.00 g zircon

Jasmine *matt*

100 g glaze
0.28 g 239 946
0.14 g 259 969¹
0.30 g 279 946

10.50 g zircon
4.00 g aluminium oxide

Melba *glossy*

100 g glaze
0.43 g 239 942
0.96 g 239 944
0.20 g 239 946

8.40 g zircon

Sorrento Blue *glossy*

100 g glaze
6.10 g 229 942
0.90 g 229 946
0.80 g 259 969¹

3.50 g zircon

Emerald Green *glossy*

100 g glaze
4.80 g 219 946
3.00 g 239 944

¹ Hazards Identification T and N; R phrases 49-61-48/23-68-42/43-51/53

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