

Technical Information

FK21

Intense Inclusion Pigments

Ferro has expanded its range of red and orange inclusion pigments with three intense colours. Available are Intense Orange 230 951, Signal Red 270 547, as well as Intense Bordeaux 270 548.

Their thermal stability is based on the encapsulation of the coloured cadmium sulpho selenide with stable zirconium silicate, like it is in the proven types of inclusion pigments. In the new pigments, an even stronger colour saturation is achieved by increasing the amount of incorporated Cd(S,Se) crystals to 4-6 weight-%. Table 1 lists the colour values in a typical glaze; figures 1 and 2 show application examples and the colour chart.

This increase causes a thinner protecting layer of zirconium silicate. Especially in zircon poor and alkaline rich glazes, this might lead to a release of the inclusions and therefore to pinholes or boiling of the glaze. These effects can be avoided by choosing the glaze carefully.

Ferro offers optimized art ceramic glazes for these intense inclusion pigments (see table 2). For leadfree applications, the glaze 40-TR166 is recommended. Depending on the firing conditions, the addition of 10 to 30 weight-% of the glaze 40 660 F enhances the colour brilliance. The firing temperature should be above 1050 °C when using the glaze 40-TR166. In a mixture with the glaze 40 660 F, the temperature can be lowered to 1020 °C, especially in a gas kiln.

For lead containing applications, we recommend our glaze 40 610 F. This glaze can be fired in a gas kiln at temperatures even below 1020 °C. The optimum mixture for such applications is 80 weight-% 40-TR166 and 20 weight-% 40 610 F.

All three mentioned glazes are intermiscible. This enables a broad area of application. The maximum colour saturation is achieved with pigment additions of 5 to 10 weight-%. The higher the firing temperature is, the more brilliant and intense are the colours of the two red inclusion pigments introduced here.

One of the advantages of the cadmium inclusion pigments is a reduced cadmium solubility compared to conventional cadmium glazes. The cadmium solubility as well as the selenium solubility of the intense pigments are below the detection limit (test in 4 % acetic acid according to DIN 1388, glaze 40-TR166).



Fig. 1: Application examples

The average particle size of the new, intense inclusion pigments is approx. 10 µm, with a d₉₀ of ca. 28 µm. On a 45 µm sieve, the residue lies at 2 %.

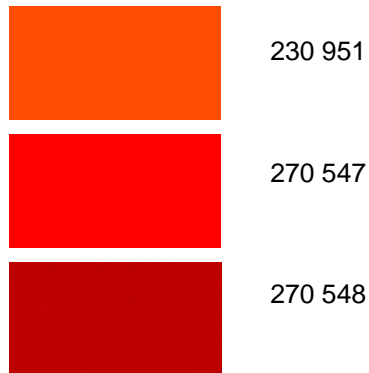


Fig. 2: Colour examples of the inclusion pigments in transparent glaze (10 % in glaze 40-TR166)

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

Table 1: Colourimetric values* of the intense inclusion pigments (10 weight-% pigment in transparent glaze, 1020 °C)

Pigment	Colour	L*	a*	b*	C*	h*
230 951	Intense Orange	58,2	44,9	43,0	62,2	43,8
270 547	Signal Red	42,7	44,7	27,8	52,6	31,8
270 548	Intense Bordeaux	38,7	37,8	17,5	41,7	24,9

*Measurement according to CIELAB 1976, 10° standard observer, D65

Table 2: Technical data of the recommended glazes

Glaze	Appearance	Temperature range	C.T.E. (*10 ⁻⁷ 1/K)	Application
40-TR166	lead free*, glossy	1050 – 1100 °C	57	shows a defect free, glossy surface and good colour saturation in combination with the new inclusion pigments, especially at a temperature of more than 1060 °C
40 610 F ¹	lead containing, glossy	1000 – 1150 °C	55	shows an extremely glossy surface and a very high grade of transparency
40 660 F ²	lead free*, glossy	1000 – 1150 °C	60	to be used for the new inclusion pigments only in a mixture with the glaze 40-TR166, never alone!

* 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.

¹Hazards identification T, R phrases 61, 20/22, 33, 62

²Hazards identification Xn, R phrases 20/22

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Ferro GmbH Performance Pigments and Colours • Gutleutstr. 215 • 60327 Frankfurt/M.

Tel. ++49/(0)69/27116-432•Fax ++49/(0)69/27116-243•e-mail: pigments@ferro.com