

COLOURING OXIDES GUIDELINES (Guideline only - depends on glaze base, type and temp of firing)

OXIDES - metallic, able to resist higher temperatures	PERCENTAGE IN GLAZE
Cobalt Oxide or Cobalt Carbonate (Blue)	1/2 - 1%
Iron Oxide (Reddish brown, tan, yellow, black)	1 - 10 %
Copper Oxide (Turquoise - oxidation, red -reduction)	2 - 5 %
Chrome (green, red, yellow, pink, brown)	2 - 5 %
Nickel (brown)	1/2 - 3%
Manganese (purple, brown)	2 - 6%
Iron Chromate (1 - 3%
Vanadium Stain (yellow)	4 - 10%
Rutile (tan, brown)	2 - 10%
Ilmenite (speckled, dark)	1 - 5%
Iron Chromate (grey, brown, black)	1 - 2%
Calcium & Selenium (red, low temp only, toxic, usually fritted as a stain 20:80)	

METALLIC OXIDE COLOURS & COMBINATIONS

ANTIMONY

Naples Yellow (unstable above cone 2)

IRON +

Cobalt = grey blue
Copper = warm green, metallic green, black
Manganese = brown
Vanadium = ochre
Rutile = ochre, brown
Nickel = brown to grey
Chrome = blackish green

COPPER +

Cobalt = blue green
Manganese = brown, black
Vanadium = yellow-green
Rutile = warm or textured green
Nickel = grey-green
Chrome = brown

MANGANESE +

Vanadium = yellowish brown
Nickel = grey or brown
Rutile = brown
Cobalt = blue-purple
Chrome = brown

NICKEL +

Vanadium = grey, brown
Rutile = brown
Cobalt = grey-blue
Chrome = brown

COBALT +

Vanadium = greyed yellow or mustard
Rutile = textured warm blue or grey-blue
Chrome = blue-green

RUTILE +

Vanadium = ochre-ish yellow
Chrome = warm green

CHROME +

Vanadium = yellow-green

BLACKS - about 2% of any combination of three oxides, usually cobalt, manganese, iron, or copper
Too much oxide (flux) may make the glaze too fluid, and you may have to adjust the clay base.
Alternately, too much may also crystallize metallic oxides as the glaze cools, to produce a dry or even wrinkled surface.

Mirror-like black: add copper oxides or iron oxides

Adding natural slip such as Alberta Slip can increase richness of blacks.

GLAZE STAIN COMBINATIONS

Stains are fritted pigments that add color to clays, slips, glazes, and underglazes. It is important to keep in mind that color development is affected by the base chemical formula in which the stain will be used, the firing temperature, and the firing method.

To test a stain in a glaze, use 2 - 4% as a test amount. This will usually show how the stain will work and will indicate if more or less stain is required. Cobalt blue stains usually require much less stain, try 1%. In general, the more stain, the darker the color.

When using opacifiers, zircopax is recommended. To add stains to clays or slips, try 4 - 6% as a starting point, then adjust.

Usually available as commercial stains, contain oxides, calcified materials, etc. Available in many varieties of colours.

i.e. **PINKS** = Chrome + Tin Oxide

Using Stains

Stains may be used in clays, slips, glazes, underglazes, in the same way you would use oxides and carbonates. Stains are fritted to ensure better color consistency.

✓ **In Glazes**

✓ Use anywhere from 1-10% stain in the glaze batch. The more stain, the darker the color. Start with 2 - 4%, then vary the amount to suit. When using opacifiers, a zirconium type is recommended (zircopax.or.superpax). Stain + opacifier should equal about 15% of the glaze. The cobalt blues, chrome-tin pinks, and vanadium yellows will accept tin as an opacifier.

✓ **In Clays & Slips**

✓ A white body is the easiest to add color to. Add stains as you would with a glaze, but add about twice as much as you would add to a glaze, then adjust to personal preference.

✓ **Firing temperatures** are only a rough guide. Firing at 2200° F on a slow schedule may give the equivalent maturing as firing at 2300° F on a fast schedule. The cycle, atmosphere, and rate of cooling will affect the color.

✓ **Zinc oxide** influences the color in a glaze more than any other element. Generally, zincless glazes should contain no magnesium oxide. Some colors containing zinc are to be used in a zincless glaze. The zinc in the color is in a combined form and will not harm the color, but free zinc oxide in the glaze can destroy the color.

✓ **Calcium oxide** content as calcium carbonate should be between 12-15% for best color development. Adding the molecular equivalent of calcium oxide with wollastonite, a natural calcium silicate, often gives better uniformity. The increased silica from the wollastonite must be subtracted or the glaze will have a poor surface.