From Clay Planet Pottery Supplies

UNDERGLAZES

As the name implies, these are not glazes. They are decorative colors that need a clear glaze over them to provide the sealing and durability qualities only a glaze with its glass can provide. Technically, they are any coloring oxide or combination of oxides (such as stains) use alone or mixed with other media such as gum & clay, that are fired onto green or bisque ware. Practically speaking, one could call glazes the glass coating and underglazes a colored clay coating. This definition would somewhat include slips and engobes as underglazes. Additionally, colored pencils and chalks and terrasigllata would fall under this broad underglazes definition.

The reason for using underglazes is to achieve different effects than can readily be achieved with a glaze. Since underglazes do not melt, becoming fluid and moving on the ware, more precise designs can be applied and two colors can be butted next to one another without losing definition. Traditionally, they are formulated to be applied to greenware. The high clay content and lack of fluxing or melt means there is high shrinkage comparable to greenware and little binding or fusing to hold the underglaze on the ware. Thus, without any additions, they are likely to crack off in the firing, or before, if applied to bisque, especially if a thick coat is applied. Decorating on fragile greenware risks breakage of the ware through handling, however. Be sure to read the labels of any commercially produced underglaze to determine whether it can be used on bisque. If not, the addition of flux will help. A simple addition of 2 to 3 tablespoons of clear low fire glaze to a pint of underglaze will generally do.

Note that most underglazes can be used as majolica-like decorating colors painted over an unfired glaze. In addition, commercial underglazes for bisque and properly fluxed others can be used as traditional over glazes, applied to an already fired glaze and refired. This works best on flat horizontal surfaces, such as tile. To get underglazes to 'stick' to a vertical glazed surface, the following may help:: 1) warm the ware, 2) add gum to the underglaze, 3) replace some or all of the water in the underglaze with alcohol. Test first, of course.

Application to Greenware:

Underglazes should be applied on a well-sponged, dust-free surface. Use a soft, good quality sable or camel hair brush. When trying to achieve a water color effect, load brush with color and apply underglaze with one continuous stroke. For over-all solid coverage, it is important to lay down or scrub in first coat of underglaze. This will act as a foundation for the subsequent 2 or 3 coats, each coat should then be applied diagonally across the previous coat. Bisque fire Cone 05-04.

Application of Bisque:

Basically the same instructions given for greenware may be followed for use of underglaze on bisque. Care must be taken that bisque is not too porous as it will have a tendency to grab or absorb too much color and thus give you a build-up which could peel or chip off. Due to the porosity of bisque, you may find it helpful to dampen the bisque before decorating, however, best results are obtained on greenware. The addition of a small amount of clear glaze to your underglaze can help fix an underglaze which might pop off during or after firing.

From Clay Planet Pottery Supplies

STAINS

Stains are in general terms, combinations of oxides that produce color. In ceramics the term is usually reserved to refer to commercially prepared colorants. The oxide or oxides, often combined with an opacifier, have been blended, then fired together (frited), and finally cooled and ground into a fine powder (usually ball milled and very fine so they can often be used in an airbrush without it clogging). They are produced by several companies for their intended use in industrial production situations that demand great color variety and extreme consistency, from which we ceramists benefit. For our practical purpose, some of the published terminology is misleading. For instance, a maximum quoted firing temperature does not mean it can't be fired successfully to Cone 10 but that the color shade may change, perhaps for the better artistically. Likewise, glaze versus body stain designations really refers to the original intended industrial production use and some variation in color shade may occur if otherwise used.

The characteristics and advantages of commercial stains over the often less expensive oxides are:

1. COLOR: Stains provide more color variations than is practical for the average person to develop. In addition, since stains are fired, the color of the powder closely approximates the fired color in a glaze, engobe, etc. This also permits easier mixing of stains to create additional colors.

2. CONSISTENCY: Color variations from batch to batch are minimal and results are predictable.

3. USE: Stains are versatile and easier to use than straight oxides. Most are formulated to remain stable at high fire and are appropriate for mixing with a variety of mediums to produce colored glazes, slips and engobes (both are underglazes), china paints, enamels, silk screen colors, decals, colored clays or direct brush or air brush application. They may be applied to greenware, bisque or even glazed pieces if refired.

4. SAFETY: Stains are technically insoluble in water since they are fritted so risks in handling the powder and wet glazes is diminished (proper masks and gloves are recommended however).

ADDITIONAL COMMENTS, USES AND SUGGESTIONS

1. Stains are refractory and need to be fluxed by the medium such as the glaze or slip or by direct flux addition (2-8%). Generally, the addition of additional flux is also recommended even if the stain is added to a glaze or slip. If known, use more of the same flux that is in the base. Otherwise, use a frit or even low fire clear glaze if it is not a low fire glaze that the stain is being added to.

2. Gas (reduction) firing is more detrimental to successful color development than is temperature. This is especially true with pinks, yellows and purples.

3. More stain is needed to achieve a given color intensity in a slip than in a glaze because the glaze is transparent and thus more of the stain is seen than only what is on the surface of the slip. Normally 10-15% but that could make an expensive slip depending on the stain added.

4. The speed of a firing and the cooling cycle can effect the color. Test with different clays and at different firing speeds if possible.

5. The addition of a "pinch" of tin oxide will brighten many colors

6. More pastel shades can be achieved by adding tin, zircopax or Mason extender (6700 for all but browns and pinks, 6001 Alpine Rose for darker chrome-tin pink stains)

7. Start testing with 2% up to as high as 25% stain additions. Initially a 2%, 5% and 10% additions should provide sufficient range for a final determination

8. Black, being total color saturation, requires at least a 10% addition, usually higher to avoid grey

9. Do not try to judge the fired color intensity by the intensity of the mix before firing, especially with the lighter yellows and pinks which invariably require more stain than one might think!

10. Zinc oxide influences the color in a glaze more than any other element. Generally, zincless glazes should contain no magnesium oxide. Some stain 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).

11. Chrome-tin stains are adversely affected by the presence of magnesium, zinc, phosphorous and antimony

12. Calcium oxide in the most common form of calcium carbonate (whiting) should be between 12% and 15% for best color development in a glaze. Adding the molecular equivalent of calcium oxide in the form of wollastonite often gives better color uniformity. The increased silica from the wollastonite must then be subtracted from the glaze formula.

13. Even a very small presence of magnesium (even from talc) will cause a shift in cobalt stains towards a more violet shade in glazes

14. If applying over an unfired glaze or to add multiple coats, cover the glaze with a gum solution (or Karo syrup solution) to prevent disturbing the glaze

15. If applying a slip to a glazed surface for refiring, mix with alcohol instead of water to prevent running

16. Stains can be mixed or combined to create additional colors

17. Generally stains can not be successfully applied to a surface as iron oxide might be to emphasize texture without at least adding a flux to make them "stick" as noted above. Additionally, it is usually difficult to apply enough straight stain to get the intensity without adding it to a slip clay or gum solution so as to be able to apply more actual stain

TO MAXIMIZE SUCCESS WITH COMMERCIAL STAINS, REFER TO THE MANUFACTURERS SPECS

SLIP, ENGOBE, UNDERGLAZE BASE

Perhaps the most common use of stains is in making colored decorating slips. Since slips (or underglazes, or engobes, all being basically colored clay) do not melt in the firing and the individual constituents thus chemically interact, many of the compatibility precautions noted above do not apply.

The base could be a slip made from the clay being used if the clay is not dark (any grog should be sieved out to prevent a rough surface). This assures compatibity in shrinkage rates. A premixed dry clay body could be purchased (we sell our Cone 10 Glacia porcelain in dry form for this purpose). A prepared low fire white underglaze or engobe could also be used up to Cone 6 although that would be more expensive. For a low fire base, a simple 50/50 mix of ball clay and talc would work. A very simple Cone 10 base would be equal parts of kaolin, flint, ball clay and feldspar. Additional flux as noted in 1 above should be added to all of these except the 50/50 mix. Following is a bit more complex but more dependable alternative, especially for Cone 10.

SLIP/ENGOBE (UNDERGLAZE) BASE

Ball Clay	15%
Frit 3110 or Gerstley Borate (flux)	20%
Kaolin	20%
Silicia	15%
Whiting (flux)	20%
Zircopax	10%
Stain	add 20%
Cone 5-6	add 10% Frit or Nephaline Syenite
Cone 05	add 15% Frit or Nephaline Syenite