

SPECTRUM[®]

PRODUCT GUIDE 2020

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SPECTRUM GLAZES PRODUCT GUIDE – 2020

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ABOUT US

Spectrum Glazes is unique among ceramic glaze suppliers in that we focus exclusively on producing the highest quality, most colorful and diverse selection of fired finishes available anywhere. All of our energies are devoted to manufacturing glazes and other ceramic coatings. Our formulations have been developed over our 40 years in business with careful attention to detail, backed by our on-going commitment to thorough testing of materials and every batch of finished product. Most of our products use ceramic frits and stains as their principal ingredients. This provides superior appearance and consistency of results over other products made primarily from raw materials. We also use a high percentage of stains in our formulations to achieve greater intensity, brightness, and depth of color in our glazes, underglazes, etc. We take great pride in being an industry leader in the development of innovative, safe and reliable products.

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MATERIAL SAFETY DATA SHEETS – MSDS can be downloaded as Word files directly from our website www.spectrumglazes.com in the download section. We will also supply printed copies on request.

LOW FIRE GLAZES -cone 06/04 (1015 to 1060°C)

(LOW FIRE CRACKLE GLAZES – 138,140,170)

138,140,170 These 3 glazes are **lead-free and non-toxic**. However, they are **not dinnerware safe** because of the possibility of bacteria growth in the cracks. After they have been fired to cone 06/04 and allowed to cool you can rub ink or dye into the cracks, in order to make the crackle pattern stand out the way it does in our color charts.

LOW FIRE METALLIC GLAZES - 151 to 156

151-156 These glazes are **lead-free**, but they are **not dinnerware safe** and they have a **hazard label for the liquid state** due to the presence of heavy metals including copper, manganese and barium. They produce beautiful metallic finishes when used correctly, as detailed below. The first 3 colors, 151, 152 and 153, are glossy type finishes. The other 3 colors, 154, 155 and 156, are matte type finishes.

There are a few important factors to be aware of when using our Low Fire Metallics (151 to 156). These glazes only work at cone 05 (1030°C). Unfortunately cone 06 (1015°C) is too cool and cone 04 (1060°C) is too hot. They also need to be put on heavily. We recommend 3 generous brushing coats or 4 normal coats. If you overfire or underfire or do not put the glaze on thick enough the result is a drab matte black or green color. Inaccurate firing temperature and insufficient glaze thickness are the most common causes of problems with the LF Metallic glazes. When these 2 factors are done correctly the LF Metallic glazes give the expected results the vast majority of the time.

To be sure that your kiln is firing to cone 05 you should put large witness cones on each shelf of your kiln. In order to check the correct number of coats for your application please fire a test piece on which you put 2, 3, 4 and 5 coats of glaze in different locations. Check your results after firing the test piece. If you are firing accurately to cone 05 and putting enough coats of glaze on but the results are not as expected, then there are some other factors that occasionally affect the result. The next factor is the clay body being used. We recommend bodies without any metal oxides, such as iron or manganese, because these can affect the LF Metallic glazes. However, sometimes even bodies without any oxides don't work so we suggest you try 2 or 3 alternate clay bodies.

Another issue we have seen is that when a kiln cools down too slowly it can encourage crystal growth that will spoil the metallic effect. This sometimes happens when kilns are very heavily loaded. A final caution is that the LF Metallic glazes should not be fired in a kiln along with bisqueware. The gases that come off bisqueware firings can upset the conditions in the kiln that create the metallic finishes.

LOW FIRE SATIN GLAZES - 250 to 264

CLEAR SATIN GLAZE

250 This cone 06/04 clear glaze has a smooth satin finish and is ideal for covering underglaze designs. It should also be applied thinly as it may cloud if applied too heavily. It is **lead-free, dinnerware safe, A/P non-toxic and also zinc free**.

OPAQUE SATIN GLAZES

251-269 These cone 06/04 glazes provide solid coverage and a beautiful satin finish. They require 2 to 3 coats by brushing. Satin glazes tend to be stiffer and do not move much in firing, so an even application is important. They are sensitive to the firing temperature, in that the hotter they are fired the smoother and glossier the surface will become. They are all **lead-free, dinnerware safe and A/P non-toxic**.

LOW FIRE OPAQUE GLOSS GLAZES - 700 to 763

CLEAR GLOSS GLAZE

700 An excellent **lead free, dinnerware safe, A/P non-toxic** clear glaze, which is compatible with most commercially available underglazes. It has good tolerance for a wide variety of low fire pug clay bodies and rarely crazes. It was designed specifically for pugged clays, and therefore should be tested before being used on slip cast ware due to the potential difference in coefficients of expansion. If you are looking for a clear glaze designed specifically for slip cast ware, consider trying our 400 Clear or 800 Clear. We recommend applying clear glazes thinly (i.e. 1 to 2 coats by brushing) as they may cloud when applied too heavily.

701-763 A wide range of **lead free, dinnerware safe, A/P non-toxic** colors, including excellent bright primary colors. These glazes require 2 to 3 coats by brushing for opaque coverage. In general, a more even appearance can be achieved by alternating the direction of brush strokes by 90° to the previous coat (i.e. first brush up and down the piece, next coat brush side to side). These glazes do not tend to bleed together so they can usually be butted against each other without the colors running.

LOW TEMPERATURE SEMI-TRANSPARENT GLOSS GLAZES - 800 to 828

800-828 These glazes are **lead-free, dinnerware safe, A/P non-toxic with the exceptions of 806, 818, 821, 822, 823, 825, 826, 827 & 828**. They can be used to produce a multi-tonal appearance. The color gets darker where it is on thicker, such as in

places where it flows into the details on pieces. Generally, it is best to apply these colors thinly (i.e. 2 coats by brushing). **The exception in this group is 800 Clear, which is a clear glaze with a slightly higher coefficient of expansion than 700. It is more suitable for slip cast ware that is generally higher in talc content and therefore higher in expansion than pug clay ware (i.e. hand-built, wheel-thrown or RAM pressed ware).**

LOW STONE GLAZES - 900 to 962

Our exciting line of low fire (cone 06/04) glazes that give the appearance of a stoneware finish.

901 to 906	Glossy, semi-transparent two-tone glazes that produce a beautiful effect when used on pieces with some detail.
907, 927, 928, 953, 955, 957, 958	Semi-gloss glazes that break and give one color in areas where they are thick and another color in areas where they are thinner.
908 to 926	Satin finish glazes and will all break to varying degrees.
929, 932 to 935, 949 to 952, 954, 956	Semi-gloss, speckled glazes.
930, 931, 936 to 943, 945 to 948, 961, 962	Satin finished speckled glazes.
959, 960	Metallic finish glazes. Best when applied thicker.
944	Solid satin taupe glaze.

We have included 900 Clear in this line which can be used, for example, to line the inside of pots. Please do not use our 900 series glazes on the same piece with our 700 series glazes. Due to significantly different expansion rates this combination can cause pots to crack.

The chip samples in our color chart which show the result of applying 3 coats of each glaze on white bisque and firing to cone 05 We have also produced many wonderful effects by layering these glazes with each other.

The following glazes are **lead-free, dinnerware safe** and **AP non-toxic**: 900, 904, 916, 925, 926, 928, 931, 932, 933, 935, 936, 937, 938, 939, 940, 942, 943, 950, 951 & 952.

The remaining colors have Health Labels for use in the unfired liquid state due to the presence of copper oxide and/or zinc oxide and/or nickel oxide exceeding the prescribed limits. They are all lead-free and dinnerware safe after firing.

RAKU GLAZES -cone 08 (950°C) plus reduction

RAKU GLAZES – 850 to 891

850-891 Our Raku glazes were developed for firing in either electric or gas kilns. The firing process is described below. Twelve of the Raku glazes are **lead-free and non-toxic** (850, 851, 871, 872, 873, 874, 875, 878, 881, 882, 883 & 884). All of the rest are **lead-free**, but are over the threshold limit for copper and are therefore **not non-toxic** in the liquid state. Our

liquid glazes (available in 4 ounce, pints and gallons) are set up for brushing application. They can also be poured or dipped on pieces, although they should probably be thinned with a little water for this type of application.

Due to the many variables involved in Raku firing, particularly during the reduction phase, our chip charts and printed color charts should be used only as **approximate guidelines**. Your results may vary greatly due to different firing conditions.

RAKU FIRING – The Raku glazes have been formulated to be fired at 1750°F (950°C) in either an electric or gas kiln. They can be allowed to cool in the kiln to 1600 F. Different combinations of peak temp and reduction starting temp will produce different results. While still red hot they should be transferred as quickly as possible into a reduction bin (typically a lidded metal garbage can or small metal container that has been lined with organic material, such as newspaper and/or sawdust, etc.). As soon as the pieces are in the bin the lid should be put on to keep oxygen from entering the container, in order to develop the reduction atmosphere. The pieces should be allowed to cool in the bin for at least 20 minutes.

WARNING: When red hot pieces go into the bin, the organic material ignites and will produce flames and smoke. This part of the firing, particularly the opening of the reduction bin, should be done outside. Always take safety precautions when firing raku such as the use of high temperature gloves, protective eyewear, and a respirator. Always have a fire extinguisher handy.

- FIRING TIPS** - Try to size the reduction bin to the size of the piece
- Establish a good seal to the reduction bin so that air is not entering and smoke is not leaving the bin.
 - Position the organic material (newspaper, sawdust, etc.) and the piece so that the flames can get all around the piece.
 - Different organic materials may produce very different results, for example a glaze reduced in newspaper could be a beautiful blue color and the same glaze reduced in sawdust could have a metallic copper appearance.
 - Pieces should be cleaned immediately with water and a hard bristle brush.
 - After cleaning, warm the pieces in the kiln to evaporate any water from the piece. This helps to set the colors more permanently.

MID-RANGE GLAZES - cone 4/6 (1190 to 1230°C)

STONEWARE GLAZES - 1100 to 1199

GENERAL

This glaze series contains a selection of 83 cone 4/6 Stoneware Glazes. All of these glazes are lead-free and dinnerware safe. Most of them also come with the A/P non-toxic rating from the Art & Creative Materials Institute (ACMI) which is clearly marked on the product label. Some of the reactive type glazes are rated C/L by the ACMI which means that they are considered toxic in the liquid (unfired) state due to the presence of heavy metals, such as copper or vanadium, beyond the non-toxic legal limit. C/L rated glazes are not suitable for use by young children or pregnant women.

We have 3 types of Stoneware Glazes: clear glazes; plain colored glazes; and reactive type glazes. These are described in more detail below. In general, clear glazes are used to cover designs created with underglazes. There is a choice of gloss, satin or crackle finishes. Most of our plain colored glazes are opaque and come in gloss and satin finishes. There are a few plain colored semi-transparent gloss glazes, such as 1111 Holly Green. Many of our most popular stoneware glazes are the reactive type colors which produce multi-tone and multi-colored effects created by a combination of various metal oxides. Many interesting effects can be created by layering these reactive type glazes with each other. In particular, layering a more fluid glaze, such as 1173, underneath or on top of one of the other reactive glazes often produces beautiful results.

All of our Stoneware Glazes are available wet in pints and gallons. They are also available dry in 10 lb. bags. The wet glazes are set up for brushing application. The dry glazes are set up for dipping application. For dry glaze mixing instructions see the sheet on "Dry Glaze Mixing Instructions" at the end of this Product Guide. Please follow the instructions carefully especially with respect to the amount of water required.

CLEAR GLAZES

- 1100 Clear Gloss Glaze (cone 4/6) – An excellent **lead free, A/P non-toxic, dinnerware safe** stoneware clear gloss glaze which is compatible with most commercially available underglazes. Like most clear glazes 1100 works best when applied thinly.
- 1120 Clear Satin Glaze (cone 4/6) – Also **lead free, A/P non-toxic, dinnerware safe** and suitable for use over underglaze decoration. Satin clear glazes are not as translucent as clear gloss glazes and will tend to mute the appearance of underglaze decoration somewhat. It should be kept thin (i.e. 1 or 2 coats by brushing) to improve clarity.
- 1187 Clear Crackle Glaze (cone 4/6) – A **lead free, A/P non-toxic** clear crackle glaze. After the piece has been removed from the kiln and allowed to cool the crackle pattern will form. A colored dye can be rubbed into the surface to emphasize the crackle pattern. Crackle glazes are not considered dinnerware safe due to the possibility of bacteria growth in the cracks.

PLAIN COLORED GLAZES

Opaque Gloss Glazes - 1102, 1103, 1104, 1106, 1107, 1108, 1109, 1110, 1118, 1131, 1132, 1134, 1135, 1136, 1137, 1138, 1151, 1164, 1165, 1166, 1167, 1168, 1169, 1184, 1185, 1186, 1193, 1194, 1195, 1196. – A beautiful selection of **lead free, A/P non-toxic, dinnerware safe** stoneware glazes with particular emphasis on bright primary colors.

Opaque Satin Glazes - 1121, 1122, 1123, 1124 1126, 1127. – Smooth satin finish on these stoneware glazes which are also **lead free, A/P non-toxic and dinnerware safe**.

Semi-Transparent Gloss Glaze - 1111 A glossy semi-transparent glaze that is **lead free** but they exceeds the copper threshold limit in the liquid unfired state and therefore is **not non-toxic**. However, it is **food safe if fired to the proper firing temperature**.

REACTIVE GLAZES

Reactive Glazes – 1113, 1115, 1117, 1140, 1141, 1142, 1143, 1144, 1145, 1149, 1155, 1156, 1170, 1171, 1176, 1177, 1180, 1181, 1182, 1183, 1192, 1199. – Are **all lead free, non-toxic and dinnerware safe**. They are formulated to produce reactions during the firing cycle which give very interesting and beautiful effects. The final appearance of the glaze is dependent on firing temperature, glaze thickness and the composition of the clay body being used. The same glaze can look quite different on different clay bodies. The samples shown on the color charts are 3 brush coats of glaze fired to cone 5 in an electric kiln on a white clay body. Different results should be expected in reduction.

Reactive Glazes – 1111, 1129, 1146, 1147, 1148, 1149, 1152, 1153, 1154, 1157, 1158, 1159, 1161, 1162, 1172, 1173, 1191, 1197. – Are **all lead free** but they exceed the vanadium and/or copper threshold limit in the liquid unfired state and therefore are **not non-toxic**. However, they **are all food safe if fired to the proper firing temperature**. They behave in the manner described above for Reactive Glazes. Also be aware that some of the colors, such as 1148, 1152, 1153, 1154, 1158, 1159, 1161, 1162, and **particularly 1173 are more fluid and may run**. Be more careful when using them on vertical surfaces. Use fewer coats towards the bottom of the piece.

METALLIC GLAZES

Metallic Glazes – 1112, 1114, 1116, 1188, 1198. – Are **all lead free** but they exceed the vanadium and/or copper threshold limit in the liquid unfired state and therefore are **not non-toxic**. However, they **are all food safe if fired to the proper firing temperature**. They are formulated to produce reactions during the firing cycle which produce the beautiful metallic effects. The final appearance of the glaze is dependent on firing temperature, glaze thickness and the composition of the clay body being used. The same glaze can look quite different on different clay bodies. The samples shown on the color charts are 3 brush coats of glaze fired to cone 5 in an electric kiln on a white clay body. Different results should be expected in reduction.

SHINO GLAZES – 1401 to 1412

All 12 Shino glazes fire to a satiny matte finish at cone 5 or a slightly shinier finish at cone 6. They are designed to break so that you see different shades of color in areas of different thicknesses. The breaking effect becomes more pronounced at cone 6 than cone 5. Five of the Shino glazes (1404, 1405, 1406, 1407 & 1411) **are lead-free, non-toxic and food safe**. The other 7 colors (1401, 1402, 1403, 1408, 1409, 1410 & 1412) **are lead-free and food safe but they have a Health Label** due to the presence of copper or manganese or zinc above the non-toxic threshold level.

ELECTRIC ASH GLAZES – 1421 to 1426

All six colors are translucent, and are designed to “gather and run” much like traditional ash glazes. The variety of colors is inspired by the different effects that come from using various fruit trees as a source of ash in reduction. One thin coat is sufficient, and they can be used on their own or over another glaze. They are all oxide based and therefore will create fascinating new colors when overlapped with other glazes. We find that they work exceptionally well overlapped with our 1100 series texture glazes as well as our 1500 series Nova Stoneware glazes. These glazes will mature at cone 4-6. Apply 1 thin coat to cone 03-05 bisque ware.

FLOATING STONEWARE GLAZES – 1431 to 1442

The name "Floating Glazes" was inspired by the idea we had while developing these colors that they should give the appearance of one color floating on top of another color. Eleven of these colors are lead-free, non-toxic and food safe. The lone exception is 1439 that is above the non-toxic limit for copper. They are all glossy reactive type glazes that produce many surprising and beautiful effects. Similar to other reactive type glazes, the final appearance of the Shinos is dependent on firing temperature, glaze thickness and the composition of the clay body being used. We have produced beautiful results on various clay bodies from white, to buff to red and even black clay. Also firing at cone 6 versus cone 5 produces interesting variations.

CELADON (SEMI-TRANSPARENT) GLAZES – 1461 to 1472

Our 12 Celadon glazes are semi-transparent, high gloss glazes that will show off detail work in your pieces by going darker where the glaze pools in areas of indentation. They are translucent enough to allow you to see decorative work, such as underglaze designs, through the glaze. Ten of these colors are lead-free, non-toxic and food safe. The lone exceptions are 1468 that is above the non-toxic limit for copper and 1472 that is above the limit for zinc. Semi-transparent glazes are notoriously prone to crazing. After some early issues with crazing we have adjusted our formulations so that you will not experience cracks in these glazes when used with the vast majority of commercial clay bodies.

NOVA STONEWARE GLAZES - 1500 to 1544

GENERAL

The NOVA line of Stoneware Glazes consists of a selection of 30 cone 4/6 glazes available wet or dry in 1, 3 and 5 gallon buckets for dipping or in pint jars and gallon jugs for brushing. In dry form the buckets contain 7 1/2 lb, 22.5 lb. and 37.5 lb. of dry glaze, respectively. The main difference between the NOVA series and our 1100 series Stoneware Glazes is that the NOVA series glazes are formulated mainly from raw materials, such as kaolin, feldspar, wollastonite, oxides, etc. rather than the frits and ceramic stains that we use in the 1100 series. There are two significant benefits from using raw materials. First, they are less expensive which leads to more economical pricing. Second, raw materials are less dense than frits and stains which makes them easier to suspend in water. The NOVA glazes are much more tolerant to being mixed with excessive water and will very rarely settle out in the way that the 1100 series can. However, it is still important to follow the mixing instructions that come with the dry glaze in order to have the glaze set up correctly for dipping.

Remove the lid and add water to the powdered glaze. For a 7.5 lb. pail add 4 pints (0.5 gallons), for a 25 lb. pail add 14 pints (1.75 gallons) and for a 40 lb. pail add 22 pints (2.75 gallons) of water to the pail. Close the lid firmly and shake vigorously until all the powder has been wetted. Remove the lid. Then, using a proper mechanical mixer such as a jiffy mixer or a drill with a mixing attachment, thoroughly mix the glaze. Add up to a pint more of water, as you are mixing, to achieve your desired viscosity. After mixing it is preferable to strain glaze through an 80 mesh sieve. NOVA dipping glazes can be thinned with water. For detailed suggestions regarding how to adjust the set up of a dipping glaze please see the section in our Product Guide titled “Guide to Adjusting Glaze Viscosity and Density”

CLEAR GLAZES

- 1500 Clear Gloss Glaze (cone 4/6) – An excellent **lead free, A/P non-toxic, dinnerware safe** stoneware clear gloss glaze which is compatible with most commercially available underglazes.
- 1501 Clear Crackle Glaze (cone 4/6) – A **lead free, A/P non-toxic** clear crackle glaze. After the piece has been removed from the kiln and allowed to cool the crackle pattern will form. A colored dye can be rubbed into the surface to emphasize the crackle pattern. Crackle glazes are considered **not dinnerware safe** due to the possibility of bacteria growth in the cracks.
- 1502 Clear Satin Glaze (cone 4/6) – Also **lead free, A/P non-toxic, dinnerware safe** and suitable for use over underglaze decoration. Satin clear glazes are not as translucent as clear gloss glazes and will tend to mute the appearance of underglaze decoration somewhat.

PLAIN COLORED GLAZES

Opaque Gloss Glazes – 1510, 1511, 1512, 1513, 1514 and 1515 – A selection of **lead free, non-toxic, dinnerware safe** stoneware glazes.

Opaque Satin Glazes – 1540 and 1541 – Smooth satin finish on these stoneware glazes which are also **lead free, non-toxic and dinnerware safe**.

REACTIVE GLAZES

Soft Reactive Glazes – 1520, 1521, 1522, 1523, 1524 and 1525 – Are **all lead free and dinnerware safe**. These glazes all have a **Health Label** due to the presence of zinc in concentrations above the non-toxic limit. They are formulated to produce reactions during the firing cycle which give beautiful effects, particularly when applied in a thin layer underneath one of the Regular Reactive Glazes listed below. Please be aware that these glazes **are more fluid and may run particularly when glazes are applied thickly**. Be more careful when using them on vertical surfaces. Use a thinner coating of glaze towards the bottom of the piece.

Regular Reactive Glazes – 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1542, 1543 & 1544 – Are **all lead free and dinnerware safe**. Colors 1531, 1532, 1533, 1542 & 1544 are also **A/P non-toxic**. The remaining colors 1530, 1534, 1535, 1536, 1537, 1538 & 1539 have a **Health Label** due to the presence of manganese or copper or zinc. The final appearance of the glaze is dependent on firing temperature, glaze thickness and the composition of the clay body being used. The same glaze can look quite different on different clay bodies. The samples shown on the color charts are one dipping application of glaze fired to cone 5 in an electric kiln on a white clay body. Different results may be experienced in reduction.

HI-FIRE GLAZES - cone 9/10 (1285 to 1305°C)

HIGH TEMPERATURE CONE 9/10 GLAZES - 1200 to 1279

CLEAR GLAZES

- 1200 Clear Gloss Glaze (cone 9/10) – Clear gloss glaze appropriate for use at cone 9/10. **Lead free, dinnerware safe, and A/P non-toxic**.
- 1201 Clear Satin Crackle Glaze (cone 9/10) – Clear satin glaze which will crackle on most cone 9/10 clay bodies. **Lead free and A/P non-toxic**. Crackle glazes are not considered dinnerware safe due to the possibility of bacteria growth in the cracks.

PLAIN COLORED GLAZES

Opaque Gloss Glazes – 1207, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1229, 1243, 1244, 1254, 1273, 1276, 1277, 1278, 1279. – **Lead free, non-toxic and dinnerware safe** range of beautiful opaque gloss glazes.

Opaque Satin Glazes – 1237 – **Lead free, A/P non-toxic and dinnerware safe** glaze that gives a smooth satin finish at cone 9/10.

REACTIVE GLAZES

Reactive Glazes – 1235 – **Lead free, A/P non-toxic, dinnerware safe** glaze is similar in usage to the cone 4/6 reactive glazes but are for use at cone 9/10.

Reactive Glazes – 1221, 1222, 1225, 1227, 1228, 1229, 1234, 1263 & 1269. – Are **lead free and dinnerware safe** but they exceed the threshold limit in the liquid unfired state for vanadium and/or copper and/or zinc and therefore have a **Health Label**. However they are all food safe if fired to the proper firing temperature. They are also similar in usage to the cone 4/6 reactive glazes but are intended for use at cone 9/10.

DECORATING COLORS

MAJOLICA COLORS - 301 to 370

- 301-370 Majolica Colors – A highly versatile product which can be used as a majolica color on top of a white base glaze or as an underglaze color underneath a clear glaze or as a glaze on its own. For majolica technique first apply 2 or 3 coats (depending on how heavily you apply each coat) of our base white glaze (i.e. 799 Majolica White for cone 06/04 firings or 1118 White for cone 4/6 firings) over the entire piece. After the white glaze has thoroughly dried you can proceed to decorating with the 300 series colors. One coat will give you the traditional majolica look, in which some of the base white shows through the color. For opaque coverage 2 coats of color will be required. For use as an underglaze use the 300 series as you would our 500 series underglazes (i.e. 1 coat – semi-transparent, 2 coats – semi-opaque, 3 coats – opaque) and then cover the entire piece with clear glaze (i.e. 700 Clear for cone 06/04 firings or 1100 Clear for cone 4/6 firings). The 300 series Majolica Colors can also be used as a glaze on its own, over a wide temperature range from cone 06 to

cone 5. It will fully vitrify at cone 06 but the surface will not be quite as shiny as our 700 series glazes. At cone 5 most of the colors will show little color change, except the pinks and purples, which are not quite as temperature stable. Using a zinc-free clear glaze, such as 1100, will improve results at stoneware temperatures. All of the majolica colors are **lead-free, dinnerware safe and A/P non-toxic**.

SUPERWRITER / SUPERSTROKE SERIES - 401 to 470

CLEAR GLOSS GLAZE

400 Designed originally as an inexpensive clear dipping glaze for castware, it does a great job of highlighting the rich colors available in our 400 series. Dip once, and fire to cone 04/05 on cone 03/04 bisque. It is **lead free, non-toxic and dinnerware safe**. It also fits most low fire pugged clays well and has therefore recently been made available in a brushing formula.

401-470 This series was designed with the contemporary studio market in mind. A collection of 70 brilliant colors that are similar to our majolica color series due to the versatility of being able to be used under or over a glaze. They are available in 8 oz squeeze bottles – great for squeezing color onto a palette, or in 2 oz pens (that can easily be refilled with the 8 oz squeeze bottle). We offer all of the colors from this series in the same 2 oz. applicator bottle as the RAC's. This is a great product for drawing decorations on your pieces.

PREPARATION - Before using the pen unscrew the black plastic cap and remove the liner from inside the cap. After screwing the cap back on the bottle, take off the clear plastic cover. The hard plastic tip has a reasonably small hole which can be used without modifications in most applications.

HOW TO USE THEM - Before using the pen on your ceramic piece, first shake the pen vigorously and then test the flow by squeezing some of the color out on a piece of paper. This should remove any air bubbles and establish a consistent flow. If the color has become too thick to flow properly, unscrew the black plastic cap and drop a few droplets of water into the bottle. Then replace the cap and shake vigorously and test again. When writing, hold the pen tip in contact with the piece. It makes it easier to control the writing than holding the tip above the piece and dropping the color onto the surface. Do not hold the pen directly vertical while writing because this leaves no gap for the liquid to flow out of. Hold the pen at an angle to the surface so that there is an opening for the color to flow through. Because the color is thicker than ink you must write more slowly than with a pen to allow time for the liquid to flow through the tip. You can create a large variety of line thicknesses by varying finger pressure and writing speed. The harder you press and the slower you write the thicker your lines will be.

HOW TO KEEP THE TIP FROM PLUGGING - The liquid in a SuperWriter pen is a type of colored glaze and like any other glaze it will harden in the pen tip unless you do something to prevent it. We recommend taking a regular paper clip and straightening out one end to use as a reamer to push into the tip. It is helpful to leave the paper clip in the tip when the pen is not in use to prevent clogging. When you are finished using the pen for the day the clear plastic cap should be replaced over the tip to prevent the pen from drying out.

UNDERGLAZES - 501 to 570

501-570 All of our underglaze colors are **lead-free, A/P non-toxic and dinnerware safe when covered with a dinnerware safe clear glaze**. Due to popular demand, we have made all 70 of our underglazes also available in the 2 oz pen package, as well as regular 4 ounce and pint jars. We offer a full palette of rich, vibrant colors that are opaque with 3 coats, semi-opaque with 2 coats and semi-transparent with 1 coat. They are compatible for use under most clear glazes. We suggest that you try them with one of our clear glazes (400, 700, 800 or 900 Clear Gloss cone 06/04, 250 Satin Clear cone 06/04, 1100 or 1500 Clear Gloss cone 4/6, 1120 Clear Satin cone 4/6 or 1200 Clear Gloss cone 9/10). Unlike many other brands of underglaze we use a frit base rather than a slip (clay) base for our underglazes. The advantages to the user are that our underglazes can be applied on greenware or bisque and they can be used with or without a clear glaze covering. When used without a clear glaze cover they have a matte velvet like surface. However, **when used without a clear glaze cover they are not considered dinnerware safe** because the rough surface can be difficult to clean and can encourage bacteria growth. Our color chart shows the unglazed color in the right (lower) half of the tile and the color when covered by a clear gloss glaze in the left (raised) half of the tile. The color chart samples were fired at cone 05. Our underglazes generally have good temperature stability up to cone 6 and for many colors to cone 10. When fired hotter than cone 04 you may get small color variations from those shown on our charts, so please test them for your application. Some of our underglaze colors will start to look glossy without any clear glaze cover at cone 5. These softer colors are 507, 530, 537, 544, 552, 560, 567 and 568. Our underglazes can be intermixed to create your own colors. However, we recommend not mixing 561, 562, 563, 567, 568, 569 with any of the other colors. These colors are based on cadmium encapsulated stains that do not mix well with other ceramic stain colors.

ONE-STROKES (CONCENTRATED UNDERGLAZES) - 600 to 638

600-638 One-Stroke (concentrated underglazes) – Are intended, as the name suggests, to give opaque coverage with one brush stroke. They are ideal for painting on designs and can be used in the same manner as underglazes. They are very similar in use to the underglazes described above. However, they have approximately twice the concentration of color as the

underglazes and are generally of a thicker consistency. All our one-stroke colors are **lead-free, A/P non-toxic and dinnerware safe when covered with a dinnerware safe clear glaze.**

OXIDE PENS -1851 to 1861

1851-1861 We have 10 oxide pens in the same easy to use applicator bottle as we use for the RAC's and SuperWriter Pens. These oxide pens contain various oxides, such as copper oxide, cobalt oxide, etc, suspended in water with small quantities of additives such as frit which improves their performance. They are particularly interesting when used on pieces that are to be raku fired.

CERAMIC STAINS - 2000 to 2090

2000-2090 Not to be confused with bisque stains which are not meant to be fired, these ceramic stains come in powder form and can be used to color glazes, underglazes, overglazes, slips and clay bodies. In general, they have greater temperature stability than many other commercially available stains. They are suitable for use from the lowest temperature ranges (cone 06) to the highest (cone 10) although colors may vary somewhat with increased firing temperature. For specific recommendations on each stain see Spectrum's **Technical Information Sheet**. Our color charts show the results for the stains mixed in our 1050 underglaze base and fired to cone 06. The strength shown on these charts was achieved by mixing 100 grams of liquid underglaze base (3.5 oz.) with 50 grams of dry ceramic stain (1.75 oz.).

Spectrum Ceramic Stains (2000 series) are inter-mixable for the most part. However, we suggest that the cadmium encapsulated colors 2082, 2083, 2084, 2085 and 2090 can be mixed among themselves but may not perform as expected when mixed with other colors. Also if you are trying to lighten a color by simply reducing the amount of stain used you may just produce a washed out look. We suggest instead that you try mixing in some of the 2000 White to lighten the color.

INDUCTRIAL STRENGTH STAINS - 2201 to 2274

2201-2274 Our 2200 series Industrial Strength Stains are very similar to the 2000 series Ceramic Stains except the 2200's are considerably stronger. This means that you may only need 50 to 70% as much stain, depending on the color, to achieve similar strength of glaze colors. The 2200's have the same range of applications and firing temperatures as the 2000's. They are suitable for use from the lowest temperature ranges (cone 06) to the highest (cone 10) although colors may vary somewhat with increased firing temperature. For specific recommendations on each stain see Spectrum's **Technical Information Sheet**. Our color charts show the results for the stains mixed in our 1050 underglaze base and fired to cone 06. The strength shown on these charts was achieved by mixing 100 grams of liquid underglaze base (3.5 oz.) with 50 grams of dry ceramic stain (1.75 oz.).

Spectrum Industrial Strength Stains (2200 series) are inter-mixable for the most part. However, we suggest that the cadmium encapsulated colors 2270, 2071, 2272, 2273, 2274, 2275 and 2276 can be mixed among themselves but may not perform as expected when mixed with other colors. Also if you are trying to lighten a color by simply reducing the amount of stain used you may just produce a washed out look. We suggest instead that you try mixing in some of the 2201 White to lighten the color.

GLAZE CRYSTALS – CR01 to CR12

CR01 – CR12 Our Glaze Crystals are all **lead-free and dinnerware safe** when fired to a minimum cone 06. These crystals are very versatile and can be used successfully from cone 06 to cone 6. They can be used with any glaze in this firing range to produce a great variety of different appearances. They can also be intermixed. Many beautiful combinations of two or more colored crystals on your choice of glaze background can be used. Please be aware that, due to varying expansion coefficients, some of these crystals may cause crazing on some glazes, particularly at stoneware temperatures. Please test for suitability in your application.

The crystals can be dropped or placed onto the final coat of glaze while the surface is still wet allowing the crystals to stick to the glaze. If the glaze dries out before all the crystals are applied, try spraying a little water on the glaze surface to help the crystals stick to it. In this way you can position the crystals where you want them on the piece. Alternatively, you can pour some crystals onto a piece of paper and dip your brush in the crystals as you are applying your final coat of glaze. These crystals may run a lot when fired up to cone 5 or 6 and should not be applied near the bottom of the piece for stoneware firings. This is not of concern at cone 06 or 05 as they will not move and spread nearly as much at lower temperatures. These crystals can also be mixed into a liquid glaze to be brushed on. However, crystals are large, heavy particles that tend to settle to the bottom of the container. Therefore, you will need to stir the glaze frequently if you choose to mix the crystals into a glaze.

RAISED ACCENT COLORS - RAC 0 to RAC 20

RAC 0-20

Raised Accent Colors (RAC's) are slip-based colors (or engobes) which are available in 2 oz. applicator pens with a hard plastic tip for decorating on greenware or bisque. They create embossed or raised designs on ceramic decorative work because the colors do not flatten out when they are fired. Some colors are also available in 16 oz. squeeze bottles, which can be used to refill the pens or which can be used for other slip trailing applications.

PREPARATION - Before using the pen unscrew the black plastic cap and remove the liner from inside the cap. After screwing the cap back on the bottle, take off the clear plastic cover. The black plastic tip has a small hole approximately the diameter of a standard paper clip which can be used without modifications.

HOW TO USE THE PEN - Before using the pen on your ceramic piece, first shake it vigorously and then test the flow by squeezing some of the slip out on a piece of paper. This should remove any air bubbles and establish a consistent flow of slip. If the slip has become too thick to flow properly, unscrew the black plastic cap and pour 2 or 3 drops of water into the bottle. Then replace the cap, shake and test again. When you are using the pen on a piece of greenware or bisque, hold the pen tip in contact with the piece. It makes it easier to control the writing than if you hold the tip above the piece and drop the color onto the surface. Also the slight scratching of the surface improves the bonding between the slip and the piece. Do not hold the pen directly vertical while writing because this leaves no gap for the liquid to flow out of. Instead hold the pen at an angle to the surface so that there is an opening for the slip to flow through. Because the slip is quite thick you need to write more slowly than with a pen. This allows time for the liquid to flow through the tip. You can create a large variety of line thicknesses by varying finger pressure and writing speed. The harder you press and the slower you write the thicker your lines will be.

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HOW TO KEEP THE TIP FROM PLUGGING - The liquid in an RAC pen is a type of colored slip and like any other slip it will harden in the pen tip unless you do something to prevent it. We recommend using a standard paper clip as a reamer since the hole in the plastic tip is just the right size for a paper clip. It is helpful to leave the paper clip in the tip when the pen is not in use to prevent clogging. When you are finished using the pen for the day the clear plastic cover should be replaced on the bottle to prevent the pen from drying out.

HOW TO REFILL AN RAC PEN - In order to refill an RAC pen, you first unscrew the black plastic cap from the top of the bottle. Then using the 16 ounce RAC refill bottles you squeeze more of the same color slip into the bottle.

MISCELLANEOUS PRODUCTS

UNDERGLAZE BASE - 1050

1050

Spectrum's 1050 Underglaze Base is formulated as a base media for preparing your own underglaze colors similar to our 500 series underglazes. The 1050 Underglaze Base has some frit in it, which acts as a flux to help the stain be a compatible fit with either greenware or bisque. It also has various additives, which keep the frit and stain suspended and makes it brush on smooth and freely. It is **lead free, non-toxic and dinnerware safe** when covered by a dinnerware safe clear glaze.

In order to achieve an underglaze of a strength similar to our 500 series Underglazes we recommend that you mix 1 part of dry powder 2000 series ceramic stain to 2 parts wet underglaze base by weight. Therefore, for example, if you put half a pint (8 oz. or 228 gm.) of 1050 underglaze base in a container you should mix ¼ lb. (114 gm.) of stain in this. This recommendation is only a general guideline as the strengths of different color stains vary and you should test colors, particularly the first time you mix them, to determine the correct strength for your application.

OVERGLAZE BASE - 1060

1060

The 1060 Overglaze Base is very similar to the 1050 except that it has additional frit to make the colors melt more easily and achieve a smooth glossy finish to the colors when they are applied on top of the majolica white glaze. Mixing instructions are the same as those shown above for the 1050 Underglaze Base. **Lead free, non-toxic, dinnerware safe.**

GLAZE ADDITIVES - 1070 to 1074

BRUSHING MEDIA

1070

Our Brushing Media is a simple gum solution that can be added to any glaze, underglaze, etc. to improve its brushing characteristics. The basic effect of adding Brushing Media to a product is to lengthen the drying time after the glaze is brushed on the piece. It also assists in glaze suspension. Brushing Media can be used if you are trying to convert a dipping or spraying glaze into a brushing glaze. The amount of Brushing Media that should be added depends on the particular products you are modifying. A rough guideline is to add about 5% of the volume of the product being adjusted. Keep in mind that the Brushing Media is largely water and that adding significant quantities of it will dilute the strength of the original product.

SUSPENDER

1071

Our Suspender is a solution of bentonite in water. It can be used to help suspend glazes that have become thin and may be subject to settling out. The amount of Suspender that should be added depends on the particular circumstances. A rough

guideline is to add 5 to 10% of the volume of the product being adjusted, as a starting point. Keep in mind that Suspender has a strong tendency to gel and that the more you add the thicker or more viscous a glaze will become.

GLAZE THINNER

1072 Our Glaze Thinner is a solution of sodium hexametaphosphate in water. It is a very powerful thinning agent and should be added sparingly. For example, 2 or 3 drops in a 4 oz. jar should have a significant effect. It is a useful product for thinning glazes, underglazes, etc. particularly when you do not want to dilute the strength of the glaze by adding water.

MENDING PASTE

1074 This is a mending paste that can be used to attach two pieces of bisque together. It does not develop its strength until after it is fired.

STAMPS BY RELYEF

STAMP SETS – RR001 to RR093

RR001 – RR093 Spectrum's Stamps made by Relyef are an exciting new product for decorating on clay. These stamps are made by 3-D printers using environmentally friendly bioplastic material. All of the stamps have a graduated angle of penetration that makes for easier cutting into the clay and an easier release than you get with other stamps. The result is a clear, clean impression in the clay. Our stamps do not leave lines on the edges. You can make your impressions as deep as you like without any tell tale borders or messy lines. Each set of stamps comes with a wooden handle for ease of use. If additional handles are needed they can be purchased as accessories. They are available singly or in packs of 10.

All of the stamps and rollers are durable and should provide years of usage in studio conditions. They can be cleaned easily in water. However do not clean them with metal brushes or scouring pads. The stamps and rollers are all recyclable since they are biodegradable in the compost. Please be mindful that these are not toys and since they are small parts they pose a CHOKING HAZARD. Please keep them away from children.

ROLLERS – RK001 to RK076

RK001 – RK076 Spectrum's Rollers are also made by Relyef using the same 3-D printing process from eco-friendly bioplastic. Like the stamps, the rollers also have a graduated angle of penetration for ease of use. They also produce clean, clear impressions without messy border lines. The rollers can be applied by hand. However there is a very convenient, easy to use roller handle that can be purchased as an accessory to be used with any of the rollers.

ACCESSORIES – RD001 to RD003

RD001 – RD003 The accessories for stamps and rollers, as mentioned above, are the stamp handle in single of 10 pack quantities and the roller handle.

BRUSHES FOR GLAZING & DECORATING

GLAZING BRUSHES – B001 to B026

B001 – B026 A variety of sizes of soft bristle mop brushes in either rounded top or flat top styles for use in glaze application. The hair type is very similar to Hake brushes. The first and most important characteristic is the hair's degree of absorbency. Hairs have scales, and the more scales, the greater the surface area to attract and hold liquids. This increased absorbency provides greater control in the application of glazes because they are held within the body of the brush, allowing for even flow off the tip of the brush.

DECORATING BRUSHES – B040 to B072

B040 – B072 A variety of sizes and types of hard and soft bristle brushes for decorating on ceramics. The softer brushes are more absorbent. When the brush is fully wet, it can come to a fine point. At the same time, it does have a little spring.

INSTRUCTIONAL MATERIAL

DRY GLAZE MIXING INSTRUCTIONS

SAFETY

The first thing to remember about any glaze in the dry powder form is that it is hazardous as a dust, so you must **take care not to breath it**. This is true regardless of whether the liquid form of the glaze is rated lead free and non-toxic or otherwise. Therefore when mixing dry glaze always work in a properly ventilated work area and wear a respirator and safety goggles.

GENERAL

On our price list you will find that all of our Stoneware Glazes, Low Stone Glazes and Raku Glazes are available dry in 10 lbs. bags, as well as wet in pints and gallons. Our standard wet glazes are all prepared for brushing application and our dry glaze are set up for dipping. Also, all of the glazes on our price list are available in dry form in 50 lbs. bags and can be prepared for brushing, dipping or spraying application.

PREPARATION

When preparing to mix either a 10 lb. or 50 lb. bag of dry glaze be aware that even though the powder is thoroughly mixed when it leaves the factory the components will tend to segregate as they are shaken about in shipping. The heavier components of the glaze will settle to the bottom of the bag. Therefore, when you are mixing dry glaze either use the entire bag or, if you only want to mix up part of the bag, make sure the entire bag of dry glaze is thoroughly mixed first. One way to mix up the dry glaze is to put it in a clean, dry 5 gallon plastic pail with a sealing lid. Rolling the pail on the floor for a few minutes should sufficiently mix the powder. Do not open the pail lid immediately after mixing; wait a few minutes for the dust to settle. Make sure you are wearing a mask.

MIXING

When mixing a glaze always use a clean vessel whose volume is at least 25% greater than the amount of glaze you expect to finish with. Put 90% of the required amount of water in the mixing vessel. Then immerse the mixer in the water and turn it on. Slowly feed the powder into the agitated water. The remaining 10% of water can be added if the glaze becomes too thick to mix properly. If the additional water is not needed hold it back to the end and add it gradually to adjust the viscosity and density. Mixing should be done with a powered mixer, which can be as simple as a drill with a paddle on the end of the shaft. Manual mixing is not recommended. After the glaze is thoroughly mixed it should be screened through an 80 mesh screen to remove any coarse particles. **Note:** Some dry glazes will come with a small pouch of ingredients labeled "add after sieving". These are materials that produce the speckled effects in the glaze and will not pass through your 80 mesh screen – add them to the wet glaze last and give the glaze a stir.

HOW MUCH WATER DO YOU NEED?

The following recommendations are just guidelines to establish a starting point and the actual quantities required may vary. The following are some typical examples of the amount of water that is required to mix dipping glazes and the approximate amount of glaze that will be made.

<u>Prod. No.</u>	<u>Description</u>	Ratio of water to Dry	Qty of water per	Approx. Qty of
		<u>Glaze by Weight</u>	<u>10 lbs. of dry glaze</u>	<u>Glaze made</u>
700-D	Clear Gloss Glaze(06/04)	0.78	7.8 lbs. = 6 ¼ pints	+ 1 ½ Gallons
705-D	Opaque Gloss Glaze (06/04)	0.63	6.3 lbs. = 5 pints	+ 1 ¼ Gallons
850's	Raku Glazes	0.65	6.5 lbs. = 5 pints	+ 1.25 Gallons (4.75 ltr.)
900's	Low Stone Glazes (06/04)	0.65	6.5 lbs. = 5 pints	+ 1.25 Gallons (4.75 ltr.)
1100-D	Clear Gloss Glaze (5/6)	0.65	6.5 lbs. = 5.25 pints	- 1.5 Gallons (5.67 ltr.)
1140-D	Reactive Hi-Fire Glaze (5/6)	0.63	6.3 lbs. = 5 pints	+ 1.25 Gallons (4.75 ltr.)
1420'S	Ash Glazes (5/6)	0.57	5.7 lbs. = 4.5 pints	+ 1 Gallon (4 ltr.)
<u>Prod. No.</u>	<u>Description</u>	Ratio of water to Dry	Qty of water per	Approx. Qty of
		<u>Glaze by Weight</u>	<u>7.5 lbs. of dry glaze</u>	<u>Glaze made</u>
1500's	Nova Stoneware Glazes (5/6)	0.76	5.7 lbs. = 4.5 pints	+ 1 Gallon (4 ltr.)

GUIDE TO ADJUSTING GLAZE VISCOSITY AND DENSITY

Unfortunately there is no perfect set up for dipping glazes that will work in all applications. The goal is to find the right set up, in terms of viscosity and density (specific gravity) that will provide the finish you want to achieve. Ideally for a clear dipping glaze you are trying to deposit the least amount of glaze that will provide a clear glossy finish over the entire piece. An opaque glaze will require a thicker coating of glaze to provide a consistent color and finish. There are several factors that affect the thickness of glaze deposited on a piece. The first is the bisque temperature. The hotter a piece is bisque fired, the tighter the body becomes and the less glaze is picked up by the piece. The formulation of the clay body being used can also affect the tightness or porosity of the piece and therefore the amount of glaze deposited. The other significant factor is the dryness or wetness of the piece. The drier a piece is when it is dipped the more glaze it will be able to pick up. This is particularly important for pieces with a lot of underglaze decoration on them. If the underglaze has not been allowed to

thoroughly dry before dipping the decorated areas will not pick up as much clear glaze as the areas of bare bisque and may look rough or partially unglazed after firing. Re-bisquing pieces that have been decorated will help minimize this potential problem.

Due to the great variety of conditions under which dipping glazes can be used our recommendations for dipping glaze set up should be used only as guidelines. They are generally appropriate. However, to obtain the best results for your particular conditions the first time you use a new dipping glaze you should dip a series of test pieces in order to determine the range of density and viscosity readings that provide the best results. The simplest way to do this is to start with a set up slightly thicker than recommended and add water in small increments, such as 2 oz. per gallon of glaze being adjusted. Dip a test piece and record density and viscosity after each addition of water. Be careful not to add too much water as glazes that are too thin can settle to the bottom of the container. The results of the fired test pieces should show you the range of density and viscosity readings that produce good results.

Specific gravity is a measure of the density of a liquid measured in grams per cubic centimeter. Water has SG=1.0, which means that 1 cc of water weighs 1 gram. To calculate the SG of a glaze divide the weight of the glaze by the weight of an equal volume of water (i.e. weigh 100 cc of glaze and divide by 100 to obtain the SG of the glaze). This can be done easily using a digital scale and a plastic measuring cylinder cut off at the 100 cc mark. Fill the cylinder to the top, weigh it (remember to subtract off the weight of the cylinder) and divide by 100 to obtain the SG.

For a dipping glaze a combination of viscosity and SG is required that will result in the correct thickness of glaze being deposited on the piece in one dip application. The usual range of SG for a dipping glaze is 1.50 to 1.70, the lower end of the range being for clear glazes and the higher end for opaque glazes. Various other factors will affect the determination of the appropriate SG of the glaze. These factors include whether the piece to be dipped is greenware or bisque, the bisque temperature, whether the piece is made from pug clay or casting slip, the moisture content of the piece, and anything else that affects the ability of the piece to absorb glaze. By comparison brushing glazes usually have SG in the range of 1.45 to 1.60.

Glaze viscosity (thickness) can be measured in terms of the number of seconds that a given volume of glaze takes to flow through a hole of a certain diameter. The easiest way to measure viscosity is by obtaining a viscosity cup, also called a Zahn cup, from a hardware or paint store plus a stopwatch. The viscosity cup is a small container with an open top and a bowl shaped bottom with a small hole to allow the liquid, such as glaze, to flow out. The cup has a handle so that it can be dipped in the glaze. Fill the cup to the brim while holding a finger over the hole. Start your stopwatch when you remove your finger from the hole. Record the time it takes until the stream of glaze breaks at the bottom of the cup and only drips remain. The number of seconds is a reliable measure of the viscosity of the glaze. Dipping glazes generally have viscosities in the 20 to 30 second range, although many of the factors mentioned previously with respect to SG may also call for viscosities outside of this range.

By maintaining the specific gravity and viscosity of a glaze within a predetermined range it is possible to control the thickness of glaze that is deposited on the piece. This is especially important with respect to dipping glazes versus brushing glazes since you do not want to vary the number of coats being applied. Also dipping glazes tend to thicken up as they are used because water is sucked out of the glaze into the bisque as pieces are dipped. Therefore it is necessary to monitor viscosity and SG on an on going basis, not only in the initial set up of the glaze.

The control of glaze thickness is essential for the production of consistent, high quality results. Glazes that are applied too heavily or too lightly are the cause of any number of glaze defects including pitting, crawling, color variation and rough spots. The most reliable way to check glaze thickness is with a thickness gauge which can be purchased through an instrument supply catalog. Hold the gauge on the surface of the unfired glaze. When the button is pressed a needle penetrates the glaze to the bisque surface and displays a reading of coating thickness in either millimeters or thousandths of an inch. However for many potters and ceramists the simple scratch test is sufficient. After dipping a test piece and letting it dry, scratch through the glaze down to the bisque with the tip of a knife. The correct thickness of glaze is usually about the thickness of a thumbnail.

Testing pieces to determine the range of glaze thickness that will produce the desired results can save many hours of unnecessary troubleshooting. Once the appropriate thickness range has been determined it can be correlated to a range of viscosity and SG values that produce the correct thickness. Maintaining viscosity and SG within the desired range can usually be achieved by the addition of small quantities of water. There are other materials, such as Spectrum's Glaze Suspender(1071) for thickening and Glaze Thinner(1072), that can be used rather than water. Achieving the proper glaze thickness on a consistent basis through the control of viscosity and specific gravity is one of the keys to avoiding many common glaze defects.

GLAZE TROUBLESHOOTING

SETTLING OUT When a glaze "settles out" some or all of the heavier components of the glaze sink to the bottom of the container. If you try to use this glaze without thoroughly re-mixing it you will be applying a partial glaze with key ingredients missing. A glaze stays in suspension due to the presence of various types of suspenders, such as ball clay, bentonite and CMC gum. One of the common causes of settling out is the addition of too much water to the glaze, which dilutes the effect of the suspension agents causing some of the heavier glaze ingredients to drop out of suspension. Another possibility is the growth of bacteria which will consume any organic materials, such as gum. This is of particular concern in the case of brushing glazes because gum is usually a large part of their suspension system. To prevent bacteria growth do not return used glaze, which has been poured out of the original container, back into that container. Also do not introduce potentially contaminated objects, such as brushes, into the original glaze container. Storing glaze in a hot or sunny environment may also encourage bacteria growth. Freezing can also destroy the action of gum, although in most cases frozen glazes can

be gradually thawed and show no ill effects. If a glaze has settled out, but has not gone rock hard on the bottom of the container, it can be re-suspended by the careful addition of Spectrum's 1071 Suspender. After a glaze has settled out and been re-suspended it is generally a good idea to filter it through an 80-mesh screen to remove any coarse particles.

CRAZING Glazes that have crazed show a fine pattern of cracks in the surface of the glaze, just the same as a crackle glaze although the latter is intended and the former is not. Sometimes the cracks are easier to detect by breathing on the piece and fogging the glaze surface. Crazing is the result of a mismatch between the coefficients of expansion of the glaze and the clay body. When the glaze has too high a coefficient of expansion relative to the clay body crazing will occur. The solution is to reduce this difference in expansions. This can be achieved by lowering the expansion of the glaze by adding a relatively low expansion material, such as silica, or by using a higher expansion clay body. You should be aware that delayed crazing can occur hours or even days after the piece has come out of the kiln if the expansion mismatch is close to the limits where crazing will occur. Delayed crazing can also occur over time as porous, exposed clay takes on moisture from the atmosphere – causing the pot to expand slightly, and cracking the glaze surface. Because of the porous nature of earthenware clay, it is not recommended to make earthenware vessels with a “dry foot” ring, but rather to glaze them entirely and fire on stilts. This is not generally a problem with stoneware or porcelain as they are vitreous when fired to maturity.

SHIVERING When a glaze shivers it cracks and pieces of the glaze peel right off the piece, often at the edges of the piece. This is the opposite condition to crazing where the expansion coefficient of the glaze is too low relative to the expansion coefficient of the clay body. One solution is to increase the expansion of the glaze by adding a high expansion material, such as a crackle glaze. If producing both castware and ware from pugged clay, be careful to test your glaze on both. Casting slip often has a different coefficient of expansion than pugged clay and as such it is possible to have a glaze that fits handbuilt or thrown pieces, but shivers off of slip cast pieces.

CRAWLING OR CREEPING When a glaze crawls or creeps it will tend to mound up and expose an area of bare bisque. This often happens in corners where glaze has built up too heavily or has not flowed all the way into the corners. Glaze can crawl because the coat is too thick or because it has not adhered properly to the bisque surface. Improper adhesion can be from bridging, such as in corners, or from the presence of dust, grease, finger oils, or other dirt on the piece. Be careful to clean the piece thoroughly before glazing. Sometimes crawling is a defect of the glaze itself caused by the use of materials that have been too finely ground. Materials that have too fine particle size create an excess of surface tension, which tends to pull the glaze apart. Crawling may also be result of a heavy application of glaze, which is allowed to dry too fast, producing cracks in the unfired surface of the glaze. This will then lead to crawling when the glaze is fired. Putting on thinner coats of glaze and allowing the glaze to dry thoroughly between each coat can resolve this problem. Another possibility is too heavy a layer of underglaze or stain under the glaze. Glaze requires a porous surface to adhere to, so anything that completely fills the pores in bisqued clay, and leaves nowhere for the glaze to seep into can result in crawling.

PINHOLES One of the most common glaze defects is pinholes, tiny holes in the glaze surface that penetrate all the way through the glaze to the body. Pinholes are caused by gases that escape from the clay body during the firing cycle. The gas originates from tiny pieces of organic matter, such as charcoal, which is present in the clay and for some reason has not managed to completely burn off during the bisque firing. The material then attempts to off-gas while the glaze is melting, and gets trapped in the glaze as the surface turns from liquid to solid. For earthenware, the best remedy is to ensure that the piece is bisque fired 2 cones hotter than it is glaze fired (i.e. when glaze firing to cone 05, bisque fire to cone 03). Other possible remedies include: a slower bisque firing cycle to give the carbon more time to burn out; a 15 minute soak at the peak temperature to keep the glaze in a liquid state a little longer; lowering the glaze firing temperature by 1 cone (for earthenware only); or using a glaze with more flux. **

BLISTERS Glaze blisters look like little craters in the glaze surface and may have sharp edges. Possible causes of blistering include: insufficient drying of the piece between glazing and firing; too dense a clay body that traps air in the piece; gas forming impurities in the glaze or body; over-firing the glaze; and a firing cycle that is too fast. The most common type of blisters comes from overfiring. More often than not, people fire without witness cones now. This means that they are unaware of differences in temperature from top to bottom in their kiln (even with the advent of kiln controllers, most kilns are not the exact same temperature from top to bottom). If firing a glaze with a range of firing temperatures (cone 4-6 for instance), then firing to the middle temperature (cone 5 in this example) will ensure that hotter spots in your kiln will not exceed the rating of the glaze. **

** always be sure to analyze a glaze defect carefully. Pinholes result in tiny craters with soft edges, whereas blisters result in slightly larger craters with sharp edges. The remedies for each are very different, and mixing up the two will likely worsen the problem.

CODE	COLOR	Aluminum	Calcium	Cobalt	Chromium	Iron	Manganese	Nickel	Praseodymium	Silicon	Tin	Vanadium	Zinc	Zirconium	can be used as body stain	no zinc in glaze	may use zinc or no zinc	zinc preferable, not needed	zincless preferred	CaO in glaze at least 7%	% stain in dry glaze for solid coverage +/- 1% 10 6 5		
2000	WHITE	X								X				X			X				X		
2001	STEEL GREY			X				X						X			X				X		
2002	BLUE GREY	X		X	X	X		X				X		X			X				X		
2003	IRON BLACK				X	X										X						X	
2004	HI TEMP BLACK			X	X	X									X		X					X	
2005	COBALT BLACK			X	X	X									X		X					X	
2010	CORAL					X								X			X				X		
2011	DEEP CORAL					X								X			X				X		
2012	BURNT ORANGE	X			X	X							X		X		X	X				X	
2013	GOLDEN TAN	X			X	X							X		X		X	X				X	
2014	HONEY	X			X	X							X		X		X	X				X	
2015	WALNUT BROWN	X			X	X		X					X		X		X	X				X	
2016	FRENCH BROWN				X	X							X		X		X	X				X	
2020	BRIGHT YELLOW								X					X	X		X				X		
2021	ZIRCONIUM YEL.								X			X		X	X		X				X		
2022	VANADIUM YEL.								X			X		X	X		X				X		
2023	MUSTARD					X			X			X		X	X		X				X		
2030	LIME GREEN								X			X		X	X		X				X		
2031	CHARTREUSE								X			X		X	X		X				X		
2032	BERMUDA								X			X		X	X		X				X		
2033	OLIVE GREEN	X	X		X									X	X		X				X		
2034	FLORENTINE	X	X	X	X									X	X		X		X	X	X		
2035	TEAL GREEN		X	X	X									X	X		X		X	X	X		
2036	PEACOCK		X	X	X									X	X		X		X	X	X		
2040	TURQUOISE											X		X	X		X				X		
2041	SKY BLUE	X		X										X	X		X				X		
2042	SLATE BLUE	X		X	X				X					X			X					X	
2043	BRIGHT BLUE	X		X													X				X		
2044	NAVY BLUE	X		X													X				X		
2045	COBALT BLUE	X		X						X					X		X					X	
2050	PEACH				X						X	X		X		X				X	X		
2051	SALMON				X						X	X		X		X				X	X		
2052	DEEP SALMON				X	X					X			X		X				X	X		
2053	MEDIUM PINK				X						X			X		X				X	X		
2054	ROSE	X					X							X			X			X	X		
2055	DEEP PINK				X						X					X				X	X		
2056	DEEP CRIMSON	X		X	X	X					X			X		X				X	X		
2057	LILAC			X	x						X					X				X	X		
2058	WINE	X		X	x	X					X			X		X				X	X		
2059	BURGUNDY				x						X					X				X	X		
2060	PURPLE			X	X						X					X				X	X		
2061	ROYAL PURPLE	X		X	X						X					X				X	X		
2070	FLESH				X						X	X		X		X				X	X		
2071	TAUPE					X			X			X		X							X		
2080	MANG. PINK	X					X							X	X		X				X		
2081	LAVENDER	X		X			X			X					X		X				X		
2082	NECTARINE	CdX				SeX								X	X		X				X		
2083	DARK RED	CdX				SeX								X			X				X		
2084	BRIGHT RED	CdX				SeX								X			X				X		
2085	BRIGHT ORANGE	CdX				SeX								X			X				X		
2086	BRIGHT GREEN								X			X		X			X				X		
2087	BRIGHT PURPLE			X	X						X					X				X	X		
2088	DARK PURPLE			X	X						X					X				X	X		

2090	ORANGE	CdX	SeX		X	X	X
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