INTERPLASTIC CORPORATION
Thermoset Resins Divison

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Tech Notes

COLOR

How to Obtain a Good Color Match

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Color: How to Obtain a Good Color Match

Background:

Color is an important attribute of a gel coat. The number of colors is essentially infinite. The Interplastic Gel Coat and Colorant Laboratory has the ability to create color standards that are high quality matches to meet the most demanding customer color requirements. Precise color communication is critical to fulfilling a customer's color expectations. This document has been prepared to provide you with the tools needed to obtain the highest quality color match for you customer's application.

Typical Color Tolerance Expectations:

The laboratory needs information about the color in one of several possible forms to begin matching a color. Color information can come in the form of a physical sample (wet or cured) or a color specification. The following list illustrates the types of color communication examples that the group can work with. The list is in order of most preferred to least preferred. The color tolerances listed are the delta E values using the CIE LAB scale. Example – if the laboratory is requested to match a physical sample of a part supplied to the laboratory from a customer, the quality of the color standard is quite good because the color standard is (a) produced using extremely accurate color instrumentation, and (b) the physical standard represents exactly the customer's color target. In this case, the plant can typically produce batches that are less than 0.35 dE units from the physical standard.

1. Physical Example (DE < .35)
2. Reference Standard from color decks (DE < .5)
3. On site measurements using portable colorimeters (DE < .7)
4. Color specifications from instrumental data without the benefit of a physical sample (DE < .7)

Physical Examples:

Physical examples of a color can come in two different forms to the lab either, a flat panel or a liquid sample. Each flat panel sent to the laboratory must be at least 2" X 2" and be free of surface defects that are not desired in the final part.

For wet samples, information regarding preparation of the sample must be required. For a gel coat the sample must have information pertaining to initiator usage. Liquid samples of colorants must contain information in regards to the preparation of the samples along with the necessary resin and filler systems if they are not available in the lab. The type of physical sample acceptable depends on physical properties of the final part.

Physical Examples Continued:

The following table shows what kind of sample is acceptable for certain material properties.

Sample Type	Glossy	Matte	Translucent	Metal Flake
Flat Laminated Panel	Yes	Yes	No	Yes
Liquid	Yes	No	Yes	Yes
Casting	Yes	No	Yes	No

Receipt of physical samples in any form are the most desirable form of color communication.

Reference Standards:

Color communication can occur by making reference to an established color standard. Five different universal color standards are available to be matched at the request of a customer. These color deck based standards include:

1) Federal Color Standard 595B
2) Pantone Matching System
3) Natural Color Standard
4) RAL Classic Color Standard
5) Sherwin-Williams COLOR

Each of these different standards is available for matching by referencing a color from within the standard. There is no need to send in a sample to be matched. Each one of these standards was developed in order to create a better method in which color can be conveyed. The use of paint chips available at any hardware store is generally not the most precise form of color communication since there is no way of know how tightly each paint company controls their color chips. The tolerance for the DE decreases in this method because of degradation of the color decks. Without proper storage techniques the customer's deck can change colors thus affecting the degree to which we can match the color. (see appendix for additional information on color deck systems)

On Site Measurement:

Sometimes the customer is unable to provide a sample of a part or find the match they are looking for from a color standard. In these cases, a member of the Gel Coat and Colorant Group can arrange to take color measurements with our portable spectrophotometer. This instrument will provide the information necessary to complete a color match. A lower tolerance on the DE of the match is possible through this method because of instrument to instrument variation.

Color Specification:

Some customers have the ability to take color measurements. Information from these color measurements can be used to match the color at our laboratories. Color information can be reported in several ways:

(a) LAB values

(b) tristimulus values (XYZ)

(c) RGB values

(d) reflectance curve.

A full reflectance curve is the best option if metamerism is a concern. When obtaining colorimetric data from another instrument, it is important to take instrumental differences into consideration. Prior round robin studies have shown that instrumental color differences vary by color, and may be as large as 0.5 dE units.

Translucent Samples:

Translucent samples allow partial transmission of light through the sample. Translucency is achieved by reducing the loading of pigments and by using pigments that absorb rather than scatter light. It is possible to provide consistent color matches with translucent samples by controlling all sources of color contribution – i.e. sample thickness, the resin color, filler color, and additive that influence color.

Fastness Requirements:

For the highest quality color matches, knowledge of the final application conditions are necessary. Awareness of curing conditions and environmental conditions (UV exposure, water exposure, and heat exposure) allow the formulator to select colorants that will provide a good match that is fit for the end-use application.

Food Contact Requirements:

The Interplastic Gel Coat and Colorant Laboratory is capable of matching colors for parts that will be in contact with food. Food contact requirement information should be shared with the laboratory to ensure the color match meets all the food contact regulations for the specific product.

Appendix 1: Color Deck Standards Available at the Interplastic Gel Coat and Colorant

Federal Color Standard 595B:

The Federal Color Standard 595B was released in 1956. It was created in response to problems with matching colors used in World War II for the military. Since then there have been multiple revisions to the standard, adding more colors over the years. All of the colors in the standard are identified by a series of numbers rather than a name. Five digit numbers are used. The first number represents the finish of the color, the second digit is the classified color category it falls in, and the final three digits represent the reflectance of color increasing order. An example is 32630, would be a color red shade that has matte finish and has a high reflectance of light. This color standard is considered old by many standards because it identifies exact colors instead of covering the color space. This standard is mainly used by within the military industry hence its creation; it is also used in historical color research and the modeling industry.

Pantone Matching System:

Pantone color standards were developed in 1963 in order to create a more uniform standard within the graphic arts community. Before use of this standard, there were problems matching and communicating colors to other within the industry. Originally the standard was based off the CMYK color model, mainly used in printing. In the CMYK model, the main colors used are cyan, magenta, yellow, and key black. Over the years, colors have been added to the Pantone system that cannot be matched using the CMYK system.

Most colors take a 15 color base pigment system to replicate. Fluorescents and metallic colors have been added to the standard over the years. The Pantone color standards can be purchased on either coat or uncoated paper. This system is in use in a multitude of industries being most prevalent in the graphic arts. Other industries using the color standard are fashion, home, paint, and plastics.

Natural Color System:

The Natural Color System (NCS) was started by the Scandinavian Color Institute, founded in 1946. NCS represents a color space which is identified as a three dimension space represented by the six base colors. Within the base colors there are the two non-chromatic colors, black and white, and four chromatic colors, yellow, red, green, and blue. Any surface color can be described within this color space in relation to the six base colors. Colors in this system are described in the flowing notion S 1050-Y90R. Here the first letter, S in this case, means that the color is standardized NCS color sample. The next four digits describe the lightness/darkness and the chromaticity of the color. The first two digits, 10 in the example, are the colors resemblance to black. The last two digits are the chromaticity of the color. Whiteness of a color can then be calculated by subtracting these two numbers from 10, in the case of the example it is 40. Hue is described in last four terms as a resemblance between the two chromatic colors listed. In the example case the hue is yellow with 90% redness and 10% yellowness. NCS is represented in 19 countries and three countries use it as their official color standard. This system is used for matching colors more often than mixing colors.

RAL Classic Color Standard:

Created in 1927, the RAL color standard originally had 40 colors. Currently the standard has 210 colors within it. All colors within the standard are represented by both a name and a number. The standard like the federal standard identifies individual colors instead of using a system to map a color space like the NCS. The varnish and powder coating industries are the main users of this system.

Sherwin-Williams COLOR:

The Sherwin-Williams COLOR system contains over 1,200 different colors. These colors were developed for the paint industries around what home owners and businesses were demanding. COLOR has developed along with the company which was founded in 1866. These colors are mainly used in Sherwin-Williams paint products, but like any other color can be matched by the Interplastic Gel Coat & Colorant group.