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CHROMATIC TECHNOLOGIES, INCORPORATED

DYNACOLOR™ DATA SHEET

THERMOCHROMIC EPOXY SCREEN INK

DESCRIPTION

DYNACOLOR™ thermochromic screen inks, in printed form, are colored below a specific temperature, and change to colorless or to another, lighter color as they are heated through a defined temperature range. These inks are available in various colors and activation temperatures. Standard activation temperatures are 15, 31 and 45° C (59, 88 and 113° F). Other activation temperatures are also available, from -5° C to 65° C. The activation temperature is defined as the temperature above which the ink has completely changed to its final clear or light color end point. The color starts to fade at approximately 4° C below the activation temperature and will be in between colors within the activation temperature range. The color change is "reversible," i.e., the original color will be restored upon cooling. See Color Availability Chart for a complete list of available colors. **DYNACOLOR™** screen ink is ideal for promotional items, temperature indicating labels, games, novelties, etc. The epoxy is a two part formulation: one part is the resin containing the color changing pigments, the other is the amber colored hardener. The two separate components must be combined in the correct ratio and thoroughly mixed prior to screen printing.

TYPICAL PROPERTIES

Viscosity (at 25° C)	90-120 poise
Density (Approx.)	8.5 lb./gal
Appearance	Viscous Liquid
Percent Solids (Approx.)	61%
Percent Volatiles (Approx.)	N/D
Food Contact Compliance Status	N/D
Yield Range (Approx.)	10,000-50,000 in^2/lb. (depending on film thickness)
Recommended Substrates	Paper, Films, Glass, Wood, Metal, Ceramic, etc.

STORAGE AND HANDLING

The inks have excellent stability when stored away from heat. The material is combustible and should not be used near open flame. Store Below 90° F. Must be used within three months of purchase. Storage longer than six months not recommended. Consult product MSDS prior to use.

Procedure: Mix the pigmented resin with the amber hardener in a **3 : 1 ratio**. For example, mix 30 grams of the colored resin with 10 grams of the amber hardener. After combining the two separate parts, thoroughly mix the components by stirring for two minutes.

Pot Life: After the components are mixed, the ink will remain a viscous liquid for up to **90 minutes** at room temperature. For optimal results, mix only the quantity desired to be printed and begin printing immediately.

Printing: Screen the ink onto the glass or ceramic surface to achieve the desired film thickness. The color intensity depends on the film thickness. A film thickness of 50 – 70 microns will give good color intensity.

Curing: The printed ink must be cured at **100 C for 15 minutes**. At lower temperatures the curing time is much longer. **The curing temperature should not be set any higher than 100 C or the ink will become discolored.** The ink should never be placed directly next to the heat source or discoloration may also occur.

SENSITIVITY

Thermochromic materials are sensitive to adverse environmental conditions. These are listed below, along with a description of the nature of the sensitivity, and recommendations with regards to them.

LIGHT: Most significantly, long exposure to UV and some fluorescent lights can degrade color intensity and changing characteristics of the ink. Extreme exposure of more than several days of direct sunlight may degrade the color of the ink, though it will probably still change colors. More than 600 hours of a strong fluorescent light may also cause a loss of color in the thermochromic. This is true of many different pigments and dyes. In handling these materials, a good rule of thumb is to assume that they art about as sensitive to light as fluorescent pigments are.

HEAT: Extended exposure to very high temperatures, i.e., 100° F or higher, can also degrade the pigment. The effect of light exposure seems to be additive over time. However, with heat, the exposure only has an effect if a given temperature is constantly maintained for a given amount of time. For instance, if a printed piece is left in a car on a hot day, out of the sun, at a temperature of around 130° F for eight hours, one might see slight degradation of the piece. If the same piece is left in the car on a cooler day, say 100° F for the same amount of time, no degradation would be seen. This could happen for months on end before any degradation was seen, as long as the piece were returned to a cooler temperature for the other sixteen hours of the day. If the piece were left in an environment where it remained at 100° F for many days, one might then expect to see a reduction in color. In other words, the effect is time- and temperature-dependent.

CHEMICALS: Thermochromic materials are sensitive to chemical exposure as well. Since it is very unlikely that the printed piece will come into contact with deleterious chemicals under normal conditions, this should not be of great concern. On the other hand, because of the chemical sensitivity and softness of this ink, it also has excellent anti-alteration properties.

CONCLUSION: In short, this ink should be stored in a cool, dry place, away from direct exposure to light, especially sunlight. This is true of both the printed ink and the wet ink. Ink in the can should be used within six months of receiving it. If the color or color reaction is compromised in a security environment, one need only to continue to verify the authenticity of the document by other means; ghost watermark, bleed through inks, etc. We predict that with proper handling, the failure rate of the ink will be less than one half of one percent, and as mentioned above, this means that one need only continue to verify authenticity and not redeem the document for cash until confirmation is established.

NOTE REGARDING HYSTERESIS: Reversible thermochromics exhibit what is referred to as “hysteresis.” In other words, if a standard “Body Temperature” ink is raised to an extreme temperature, say above 150° F (as with a curing unit), then left to cool under normal ambient conditions (65° to 75° F), the ink may not achieve its full color, even after it reaches room temperature. Although, under normal circumstances the ink should have full color up to 7-8 degrees below the stated activation temperature, once exposed to this kind of temperature “spike,” one may need to lower the ink’s temperature to below 50° F to gain improved behavior. ALL APPLICATIONS USING COLOR-CHANGING INKS OF ANY KIND SHOULD BE THOROUGHLY TESTED PRIOR TO APPROVAL FOR PRODUCTION.

For further information or assistance, please contact Chromatic Technologies, Inc. at (888) 294-4CTI.