GUIDELINES FOR USING PRIZMALITE® P2453BTA RETRO REFLECTIVE SPHERES

DESCRIPTION:

Prizmalite® P2453BTA microspheres are hemispherically aluminum coated solid glass microspheres made of barium titanate glass. The aluminum coating on half the barium titanate sphere provides the mechanism for retro reflectivity. The light passes through the clear half of the sphere and "bounces" off the aluminum coating. The Refractive Index of barium titanate glass is higher than that of most glass and determines the angle of the light's direct return back to the light source. The combination of barium titanate's RI of 1.9 and the hemispheric coating of aluminum creates retro reflectivity and accounts for the more intense and direct light refraction achieved.

Prizmalite® enhances the retro reflective effect by applying certain proprietary and patented coatings to its **P2453BTA** microspheres. These coatings have been designed to promote the migration of the microspheres to the surface of the inks or coatings in which they are incorporated. The concept of retro reflection depends on the passage of the light through the clear, uncoated hemisphere of the glass sphere. If the sphere is not physically situated for light to pass through it, no retro reflectivity can result. **Prizmalite**'s coatings create a tension between the coating and its surrounding resin that forces the sphere to "pop up" to the surface, thus maximizing its potential exposure to light. Coating the spheres enhances the retro reflective effect by achieving this placement and reduces the amount of spheres required because the coated spheres perform so much more efficiently than uncoated ones.

RECOMMENDED APPLICATION AMOUNTS:

Prizmalite® P2453BTA can be added directly to plastisol ink for application to fabrics being printed using silk screen or rotary screen processes. The amount of **P2453BTA** to add should be calculated on a dry weight basis. **Prizmalite®** recommends a ratio of between 1 to 2 parts beads to 1 part plastisol ink, but the exact ratio depends on the level of desired retro reflectivity, the type of fabric and the application method.

As a general guideline, most plastisol inks are 100% solids so 25 grams of plastisol ink has a dry weight of 25 grams. The amount of **Prizmalite® P2453BTA** microspheres to add to this ink would range between 25 and 50 grams, depending on application techniques and aesthetic objectives. **Prizmalite**'s experience has indicated that the ratio of added spheres can be at the lower range of 1 when **Prizmalite's** proprietarily-coated **P2453BTA** spheres are used**.**

When fully mixed [continuing the above example], the plastisol ink containing the **P2453BTA** spheres would weigh in the range of 50 grams [1 part ink to 1 part spheres] to 75 grams [1 part ink to 2 parts spheres]. Depending on the type of fabric being coated, the intricacy of the pattern or screen, and the desired thickness of the deposited ink or coating, **Prizmalite®** recommends deposition of about 17 grams to 25 grams of the mixed ink per square meter of fabric.

APPLICATION CONSIDERATIONS

Prizmalite® P2453BTA spheres can be applied using any system that works with plastisol inks, most typically, rotary screen or silk screen systems.

The type of fabric being coated or printed determines the amount of coating or ink deposited: the smoother the fabric, the less weight is required. If a coarser or more absorbent fabric, it is necessary to apply more weight of the coating or ink. Finishing coatings, such as for water repellency, must be applied after the unfinished fabric has been printed.

The viscosity of the ink depends on three factors: the speed of the equipment; the pressure settings, and the type of fabric being printed. **Prizmalite®** recommends viscosity in the range of 15,000 to 25,000 centipoise, as measured by a Brookfield viscometer **after** the **P2453BTA** spheres have been added to the ink. If viscosity is greater than 25,000 centipoise, water can be added directly to the ink until the lower targeted viscosity is achieved. **Prizmalite®** does not recommend applying the ink at a viscosity lower than 15,000 centipoise. Because the **P2453BTA** spheres are so dense, it is important to keep them well mixed in the ink during application.

The addition of **Prizmalite® P2453BTA** spheres will not affect or distort the color of the ink being applied. Color blending by adding a pigment directly to the plastisol ink can be done but there are limitations: exact color matches are difficult, lighter color is harder to match and darker colors require more pigment and thus can reduce the retro reflectivity.

SILK SCREEN APPLICATION METHOD

When using a silk screen process, it is necessary to determine the largest mesh size and the lowest viscosity that allow the system to operate without clogging the screen. **Prizmalite®** generally recommends a screen in the range of 80 to 120 mesh. If the silk screen does become clogged when applying the ink, spray it with high-pressure water. Alternatively, to minimize clogging, the viscosity of the ink can be adjusted by adding water before printing.

The drying and curing time of a silk screen printing process is considerably faster than that of a rotary screen process: typically, one to two minutes at 135º C.

ROTARY SCREEN APPLICATION METHOD

Generally an air pump transfers the ink into the screen. Pressure is applied to the rotary screen in the range of 5 to 20 pounds, depending on the fabric being coated and the speed of the machine. The more pressure applied, the less weight of the coating deposited. The more pressure applied also pushes the spheres to break the surface of the ink, which should enhance retro reflectivity.

The rotary screen should be wide enough to cover the width of the textile to be printed and with the openings in the range of 80 to 120 mesh. The pattern of the screen can be whatever the customer wants, depending on coverage requirements and cost considerations. Generally, however, the simpler the pattern being printed, the better the final results. It is best to avoid complex patterns composed of many small lines, curves or tight sharp points since complexity will lead to problems in printing.

In a rotary screen printing process, the time and speed necessary to meet the drying and curing parameters depend on the length of the oven: the longer the oven, the faster the processing time. Typically after application using a rotary screen, the coated fabric should be run through an oven at least 18 meters [20 yards] long to eliminate excess water. The initial 9 meter heating zone should be at a temperature of 121ºC and the second 9 meter zone at a temperature of 149ºC, for a total drying time of about 2 minutes. After the drying heat process, the fabric should enter a curing box or oven at a temperature of about 177ºC for approximately 45 seconds. Curing at temperatures higher than 177ºC is not recommended as the fabric and coating can be damaged or degraded.

Because of the high density of the **Prizmalite® P2453BTA** spheres, there is the potential for their uneven distribution and their being "pushed" to the edges of the rotary screen over time due to centrifugal force. This tendency can be overcome by pumping more ink into the screen and continuously mixing the materials during the printing process.

When rotary screen printing, the process is more convenient and efficient if a tenter frame is used. A tenter frame prevents shrinkage of the fabrics when heat is applied and is generally required in any high volume printing operation. Certain open fabrics such as mesh fabrics can shrink by up to 50% unless held by a tenter frame.