Photochromic Dyes & Pigments

Description

H.W. Sands' photochromics reversibly alter their color upon exposure to ultraviolet sources. These chameleon-like dyes respond to natural solar irradiation as well as artificial sources such as 365 nanometer "black light." When sunlight or ultraviolet (UV) radiation is applied, the dye becomes excited and the molecular structure is changed allowing a color to appear. When the stimulus (sunlight/UV) is removed, the dye will return to a state of rest, which is its colorless form. Photochromic molecules are not reactive in their crystalline state and need to be dissolved in a solvent or polymer to function.

Application Suggestions

A. **Photochromic Dye** – optically grade material compatible with solvent based flexographic, UV, screen, offset, gravure and epoxy ink formulations.

B. **Photochromic Pigment** – microencapsulated photochromic dye for high temperature processes.

Product Properties

Colors	Photochromic Dye	Photochromic Pigment
Yellow	MSA6553	MSA6547
Orange	MSA6554	MSA6548
Red	MSA6556	MSA6549
Blue	MSA6557	MSA6550
Royal Blue	MSA6558	MSA6551
Violet	MSA6559	MSA6552

Printing Recommendations

General Recommendations

Photochromic inks must be printed and dried in a clean environment. Always be sure that the screens, squeegees, knives, spatulas, or any other equipment that comes into contact with the photochromic inks are clean and dry, completely free of all solvents or other matter. In addition, the sensitivity of the photochromic inks to UV light and high temperatures and specific chemicals should always be considered.

Screen Inks

Photochromic screen inks can work on hand or automatic (rotary or flat-bed), sheet or web-fed screen printing equipment. A US 80-150 mesh polyester monofilament screen or lower is recommended. It is preferable to use a medium or medium-hard (65 durometer) rounded edge squeegee.

Dispersing/Mixing

The Photochromic dye/pigments are compatible with standard mixing procedures. Be careful not to grind or damage the pigment version through aggressive dispersion techniques (e.g. Ball Mills). This will destroy the structure of the microcapsules and color changing properties.

Compatible Solvents

Toluene	Xylene	Methyl Ethyl Ketone	Ethyl Acetate	Most Organic Solvents

Non-Compatible Solvents

Water*

While the photochromics are insoluble in water, they can be treated like other water insoluble materials and "tricked" into water based systems.

Recommended Concentrations for Ink, Paint and Plastic Formulations

Product	Ink/Paint (Solvent)	Ink/Paint (Aqueous)	Plastic Injection/Extrusion
Dye	2.0% - 10.0%	2.0% - 10.0%	0.1% - 1.0%
Pigment	3.0% - 30.0%	3.0% - 30.0%	0.2% - 5.0%

Heat and Drying

Opacity

The opacity of the photochromic pigment is directly related to the color, concentration and print thickness. Their color intensity is lower than a typical color pigment. Dark colors such as black can be used to hide an image whereas lighter colors such as yellow can not. Achieving this concealing effect requires higher concentrations and multiple print passes.

Heat

H.W. Sands' photochromics can be imbibed, extruded, injection molded, cast or mixed in plastisol. H.W. Sands' photochromics can withstand processing temperatures of 180°C to 240°C (350°F - 460°F) for short periods without degradation. Thermal degradation is a function of the combination of time and temperature. Therefore, avoid prolonged exposure to high processing temperatures.

Stability

Store the pigments at ambient temperatures (20-25^{O}C) out of direct sunlight and away from excessive heat or sources of ignition.

FAQ's

Q. **How long-lasting is the photochromic feature?**

A. Certain photochromics will not last as long in materials that form acids when exposed to sunlight. In plastisol, half lives of greater than 40 hours in a QUV panel have been achieved. (The half life is the time it takes to reach one half the initial change in color intensity.) Products made from solvent cast urethane have shown a half life greater than 2,000 hours.

Q. **What does the photochromic need to be protected from?**

A. The photochromic molecule needs to be protected from free radicals such as singlet oxygen, oxidizers such as peroxides, acids, laminating adhesives containing ammonia, ammonia containing compounds or amine compounds and high energy ultraviolet, UVB. While it is robust in the closed or colorless form, it is most susceptible to attack in its open or colored state.

Q. **Some days the photochromic is darker than on other days. Why?**

A. The photochromic feature is affected by the following:

- The amount of activating UV present (the UVA spectrum changes during the day)
- Temperature (high temperature promotes conversion of the colored to the colorless form)

Q. **Sometimes there is a residual color when it should be clear. Why?**

A. There is some residual color with all photochromics that can be controlled by:

- A reduction in the photochromic loading
- A reduction in the processing temperature

All applications using this product should be thoroughly tested prior to approval for production.