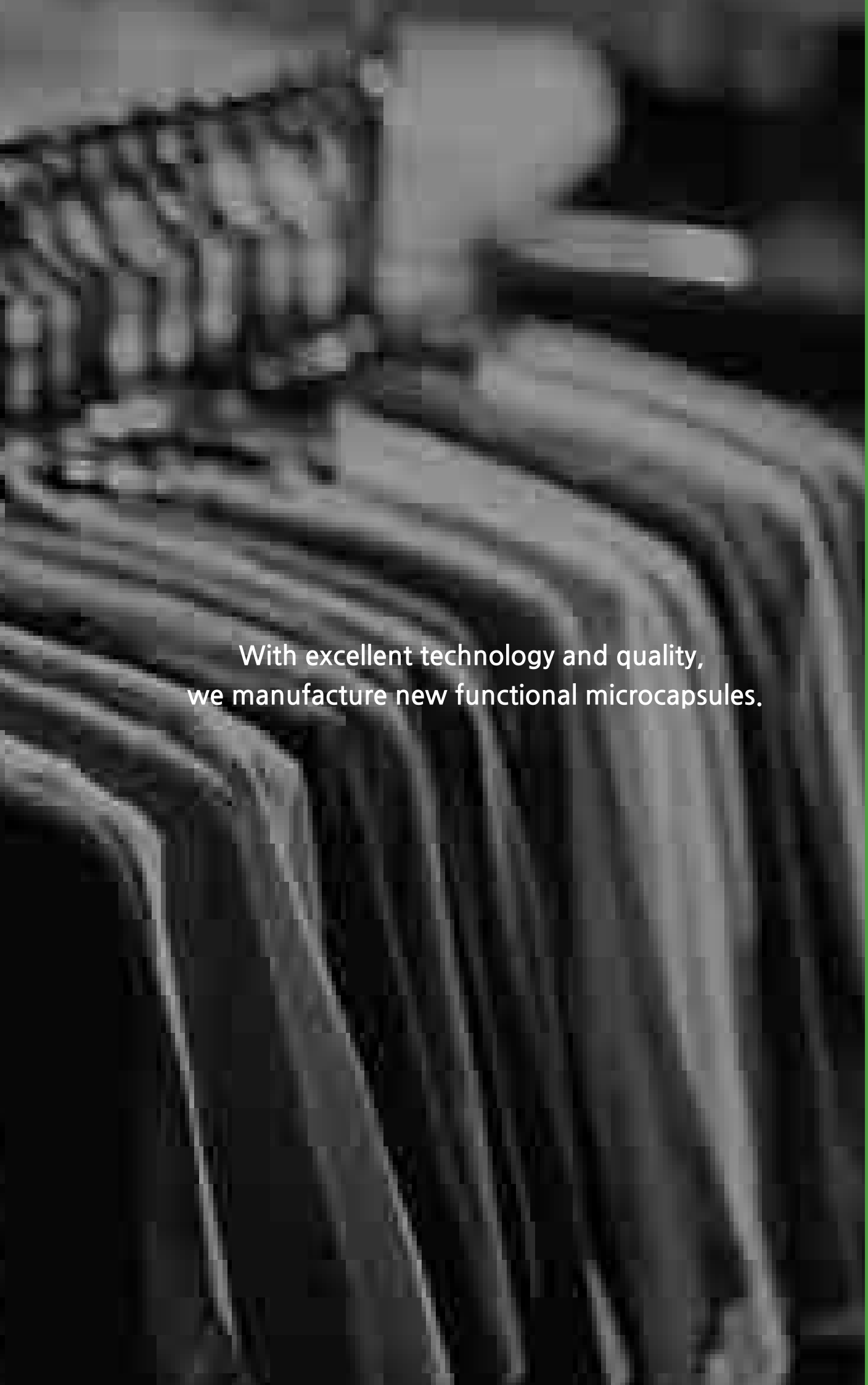
Functional Microcapsules

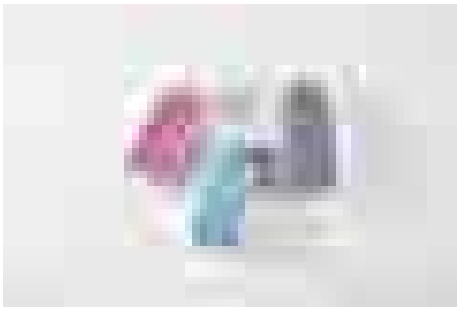
insilico

NEW WAYS TO NEW MATERIALS



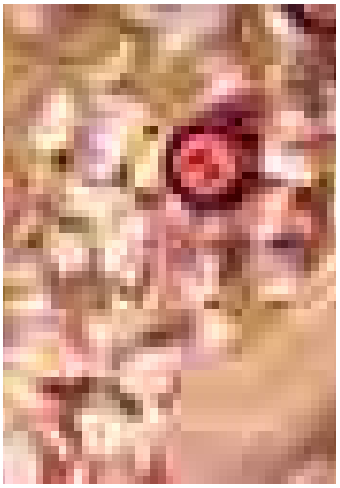
NEW WAYS TO NEW MATERIALS

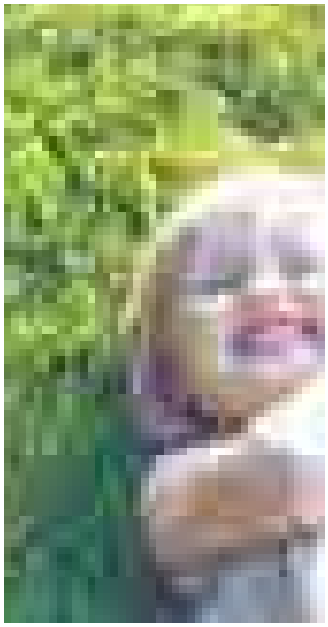
CONTENTS



Thermochromic Products

Photochromic Products





☑ Functional Products

Thermochromic Microcapsule

This is a microcapsule product with a special thermochromic dye, which changes color according to temperatures. The thermochromic dye causes the change of color by the heat-induced chemical structure change. Since it is very sensitive to the external environment, it is made as a microcapsule-type product for protection and thus its repetitive durability is increased. Thermochromic microcapsule has various colors. Because a temperature for changing color can be adjusted variously, you can properly choose diverse types of product according to colors and temperatures.

PRODUCT

Powder(Oil-based)
Chameleon T P-Series

Slurry(Water-based)
Chameleon T S-Series

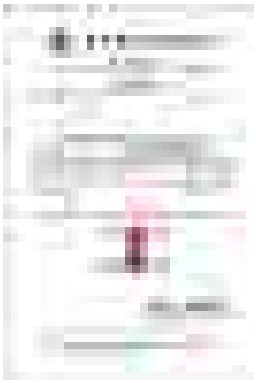
APPLICATION

Textile, Coating,
Plastic Injection,
Supplies, Ink

COLOR

Red, Orange, Yellow
Green, DarkBlue
FastBlue, SkyBlue
TurquoiseBlue, RealViolet
BlueViolet, Magenta
RoseRed, Vermilion
Brown, Black

TEST REPORT



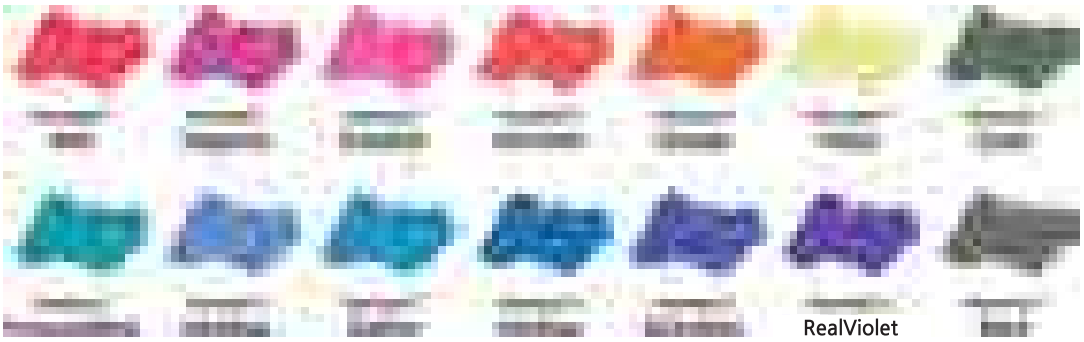
Color Fastness to Washing,
Grade: 4~5
KOTTI

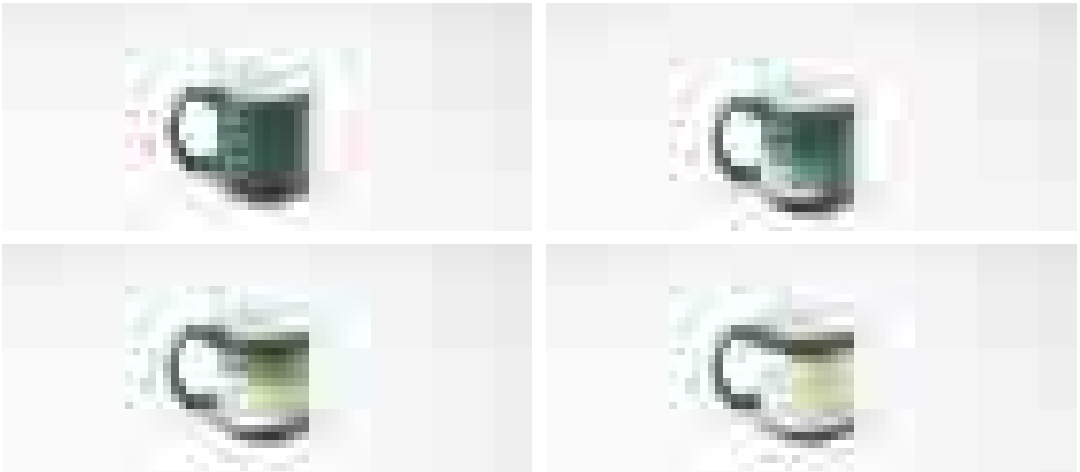
Principle of color change

When heat is applied to thermochromic microcapsule, the substance structure inside the microcapsule changes and consequently its color disappears. At cooling time, the internal substance structure of the microcapsule returns to its original state reversibly, and thus the microcapsule has color.

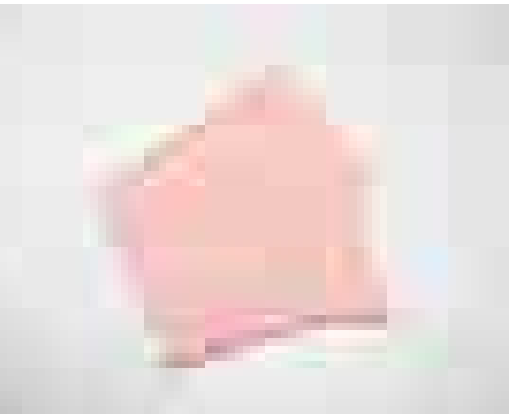
* Temperature for changing color: 0~70°C

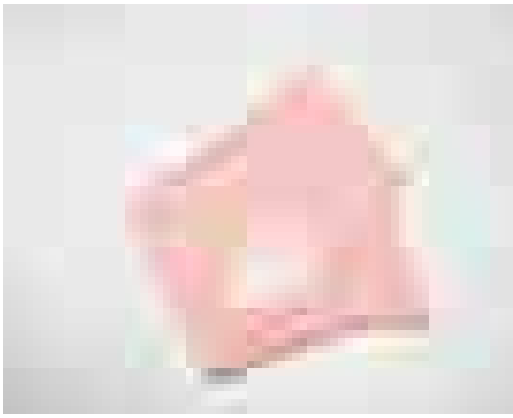
Chameleon T Color Code





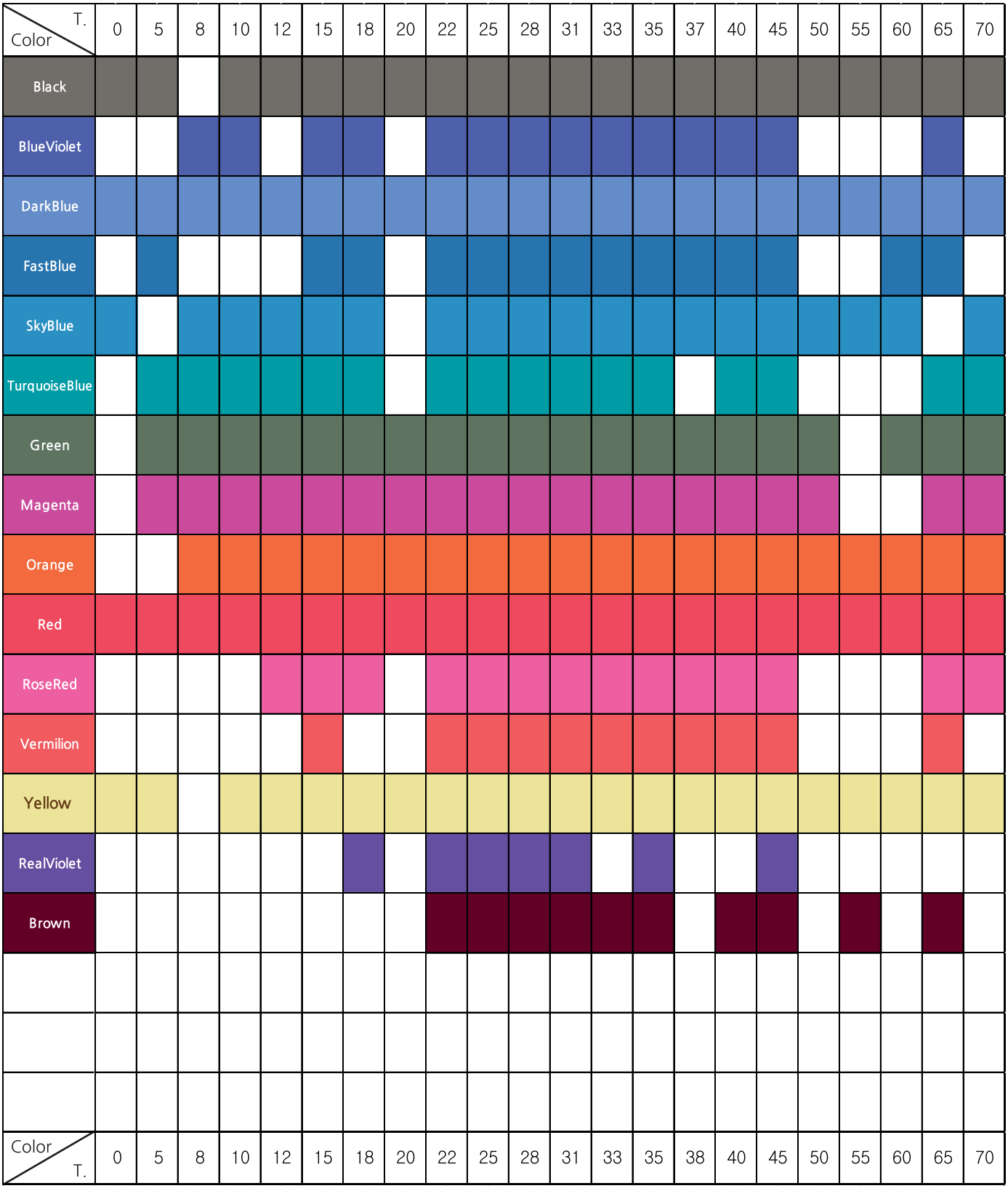
Thermochromic color change





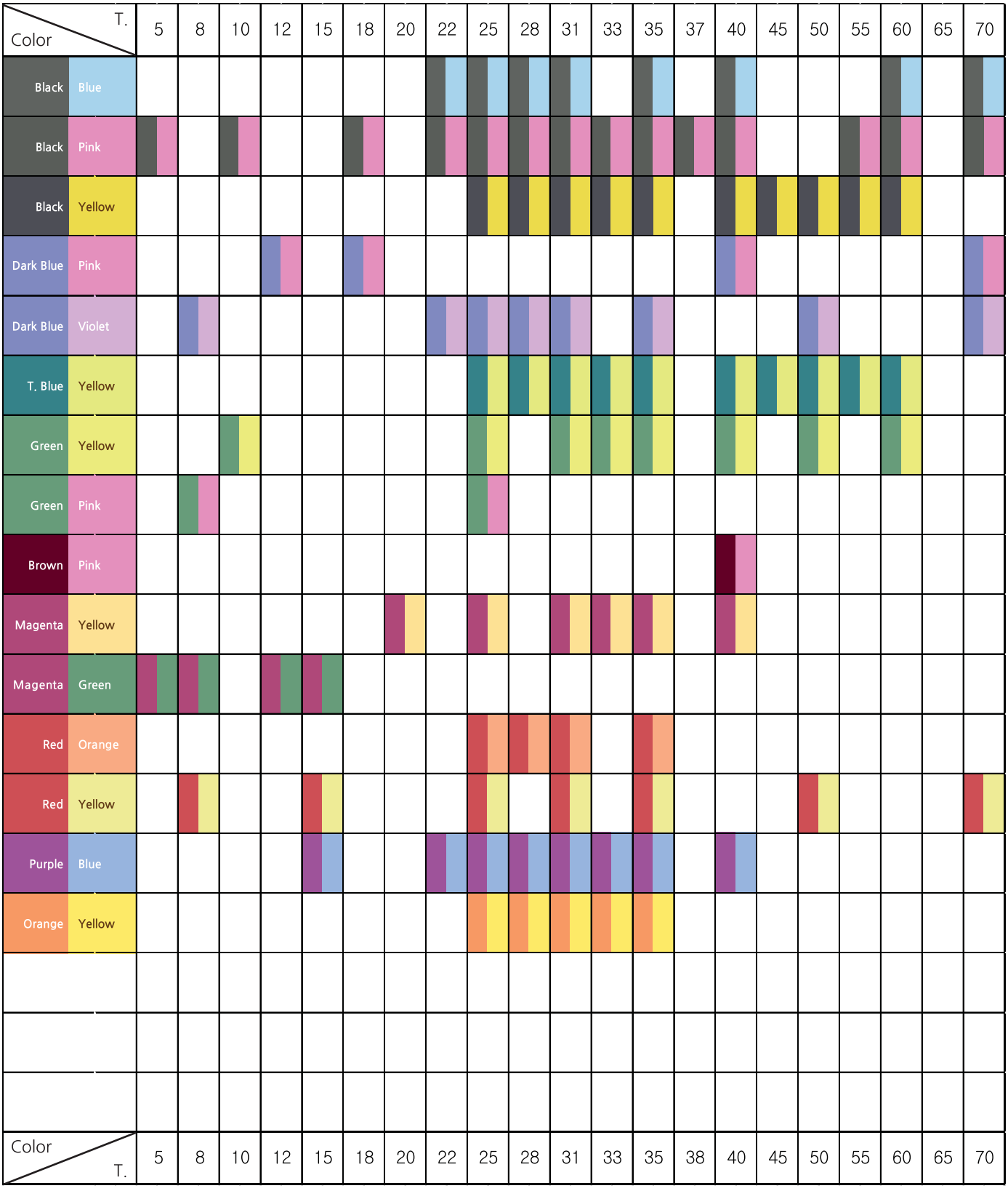
Application examples

Thermochromic Chameleon Series



The color of this table dosen't match up with real color shade.

Thermochromic Bichrom Series



The color of this table dosen't match up with real color shade.

Bichrom Thermochromic Microcapsule

PRODUCT

Powder(Oil-based)
Bichrom T P-Series

Slurry(Water-based)
Bichrom T S-Series

APPLICATION

Textile, Coating,
Plastic Injection,
Supplies, Ink

COLOR

Green ↔ Yellow
Orange ↔ Yellow
Red ↔ Yellow
Black ↔ Yellow
TurquoiseBlue ↔ Yellow
Magenta ↔ Yellow
Red ↔ Orange
Black ↔ Pink
Black ↔ Blue
DarkBlue ↔ Violet
Purple ↔ Blue

Bichrom dye features the change of color by the structural change in specific conditions. Since the dye is very sensitive to the external environment, it is made as a microcapsule-type product to extend the period of its repetitive function. The microcapsule with the dye is called **Bichrom Microcapsule**.

Bichrom Microcapsule has various colors. Because a temperature for changing color can be adjusted, you can properly get diverse types of product according to colors and temperatures.

Difference from the standard thermochromic microcapsule(Chameleon T series)

Chameleon Microcapsule changes from being colored to being colorless reversibly. But, **Bichrom Microcapsule** changes from being colored to being colored and thus is applied to a wider range of areas.

Principle of color change

When heat is applied to **Bichrom Microcapsule**, the substance structure inside the microcapsule changes and consequently its color disappears. At cooling time, the internal substance structure of the microcapsule returns to its original state reversibly, and thus the microcapsule has its original color.

* Temperature for changing color: 0~70°C

Bichrom T Color Code

Erasable Microcapsule

PRODUCT

Powder(Oil-based)
SpyBall P-Series

Slurry(Water-based)
SpyBall S-Series

APPLICATION

Erasable ink
(ball point pen)
Cable

COLOR

Black, Blue, Red, Green
Magenta, Orange
RoseRed, Vermilion
Yellow

As a kind of thermochromic microcapsule, SpyBall has a property which its color disappears and recovers in accordance with temperature.

If it exceeds the specific temperature, its colors disappear and then recover below the specific temperature in accordance with chemical structure change of substance within capsule. We can make colors disappear in specific part by generating heat caused from friction utilizing this principle, disappeared colors to be recovered by lowering temperature below zero.

Principle of color change

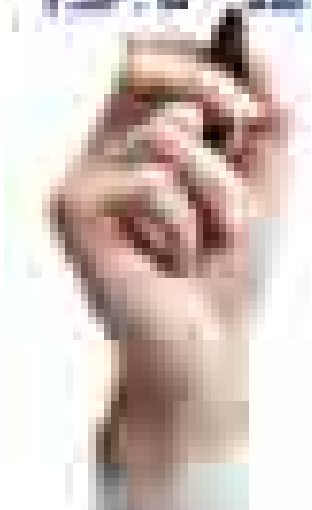
It maintains color changes in the range which is wider than existed thermochromic microcapsule products by using special matrix which induces the change of chemical structure in accordance with temperature.

SpyBall product decolors over 60℃ or 80℃. Once its color disappears, it colors back only under low temperature where there is few possibility of coloring during daily life.

SpyBall Color Code

SpyBall P-Series

Spyball Powder applied on electric cables could prevent an electrical fire caused by overheating.



SpyBall S-Series

SpyBall Slurry can be used
as an erasable ink of ballpoint pen.

Reverse Thermochromic Microcapsule

PRODUCT

Powder(Oil-based)
Reverse Thermochromic P-Series

Reverse thermochromic microcapsule is a product with thermochromic dye, which reveals its color according to increasing temperature. The reverse thermochromic dye changes its color by the heat-induced chemical structure change. Since the dye is very sensitive to an external environment, it is made as a microcapsule-type product for protection, enhancing its repetitive durability.

Principle of color change

APPLICATION

Textile, Coating, Ink
Supplies(Mug cups, etc)

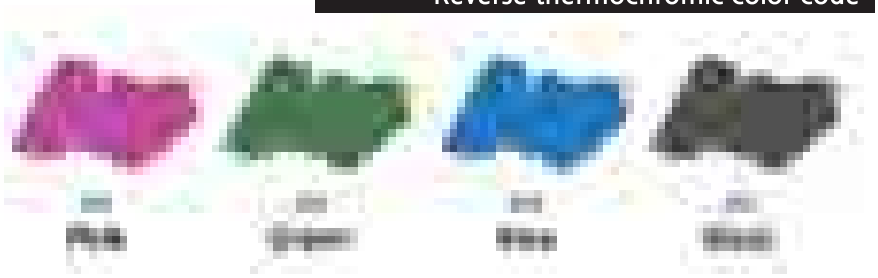
When heat is applied to reverse thermochromic microcapsule, the substance structure inside the microcapsule changes and the color appears. When cooled down, the microcapsule recovers its original structure, and the color disappears.

* Available temperatures: 40℃, 60℃

COLOR

Pink, Green, Blue, Black

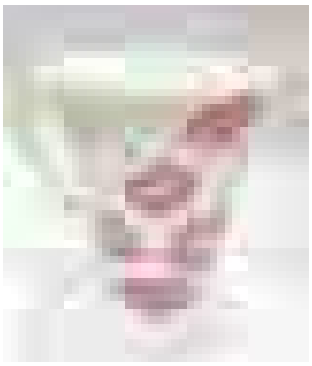
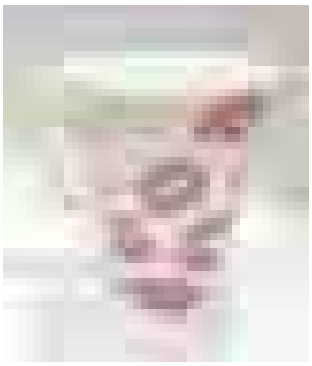
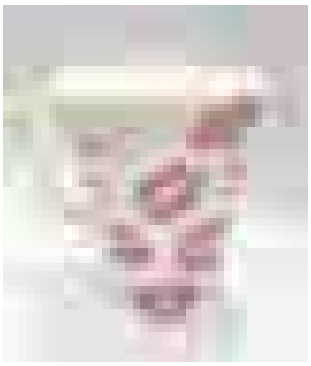
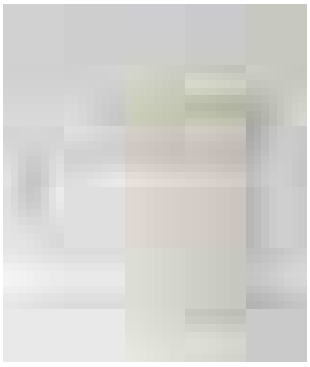
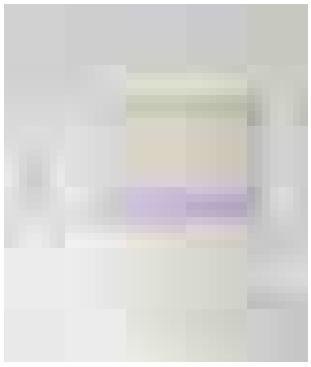
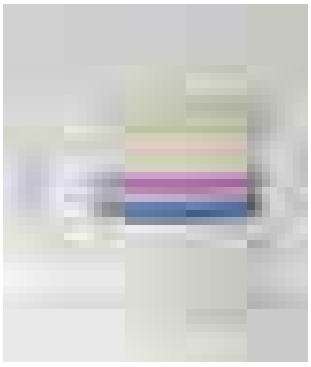
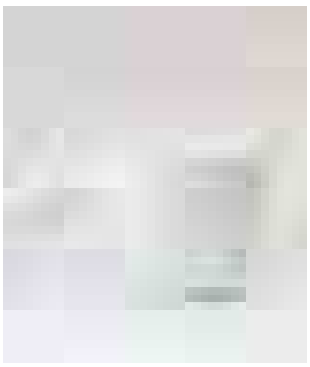
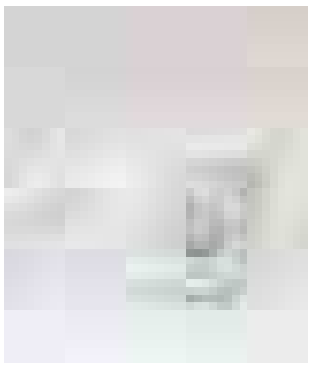
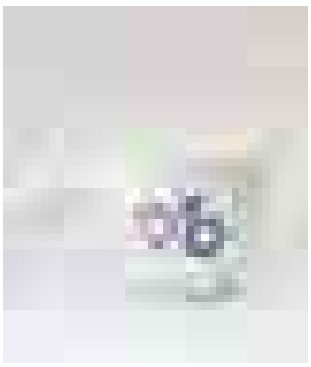
Reverse thermochromic color code



Difference from the standard thermochromic microcapsule(Chameleon T series)

Chameleon T microcapsule changes its color from colored to colorless while the reverse thermochromic one from colorless to colored reversibly.

Application examples

Photochromic Microcapsule

PRODUCT

Powder(Oil-based)
Chameleon UVC P-Series

Slurry(Water-based)
Chameleon UVC S-Series

This is a microcapsule product with photochromic dye which changes its color by light. The photochromic dye causes color change reversibly by light. When it is exposed to ultraviolet rays (sunlight), it causes color formation, and when light is blocked, it has its original color.

Since it is very sensitive to the external environment, it becomes encapsulated in micro synthetic resin with several ㎛ to hundreds ㎛ in diameter for protection and stability increase.

APPLICATION

Textile, Coating,
Plastic Injection,
Supplies, Ink

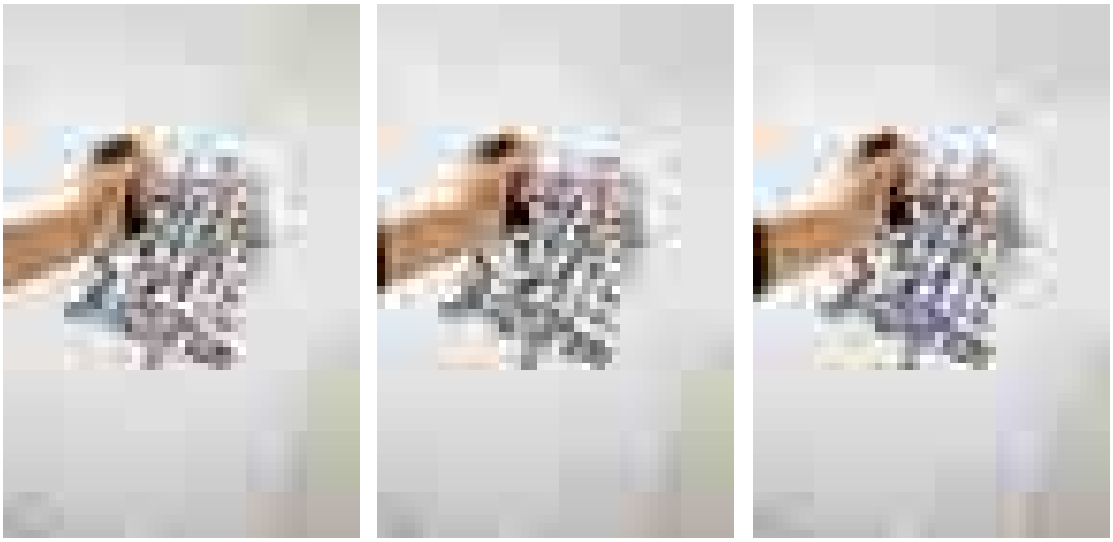
Principle of color change

When photochromic microcapsule is exposed to sunlight like UV rays, the structure of the internal substance of the capsule changes and thus it has color. And when light is blocked, the internal substance of the capsule returns to its original state, and consequently its color disappears.

COLOR

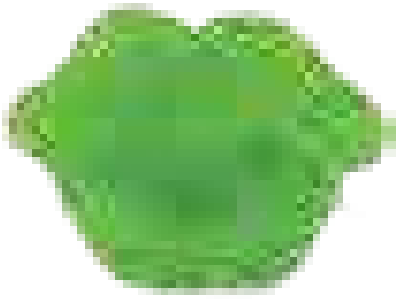
Red, Violet, Blue
Yellow, Orange

Chameleon UVC Color Code



Photochromic color change

Application examples



Bichrom Photochromic Microcapsule

PRODUCT

Powder(Oil-based)
Bichrom P P-Series

Slurry(Water-based)
Bichrom P S-Series

Bichrom P Series is a reversible photochromic microcapsule that its color in lightless state changes to other color once exposed to light.

Since it is very sensitive to the external environment, it becomes encapsulated in micro synthetic resin with several ㎛ to hundreds ㎛ in diameter for protection and stability increase.

APPLICATION

Textile, Coating,
Plastic Injection,
Supplies, Ink

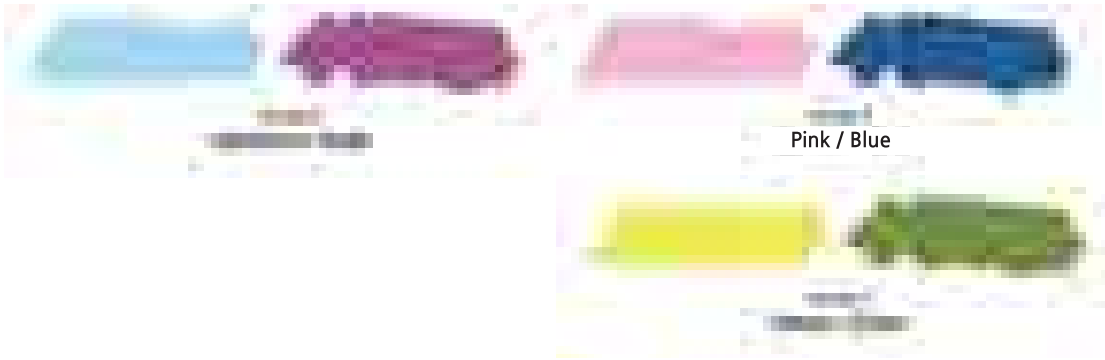
Principle of color change

When sunlight is applied to **Bichrom Microcapsule**, the substance inside the microcapsule changes and consequently its color disappears. When light is blocked, the microcapsule has its original color.

COLOR

Yellow ↔ Green
LightBlue ↔ Violet
Pink ↔ Blue

Bichrom P Color Code



Photochromic Dye

PRODUCT

PolyShine Blue
PolyShine Red
PolyShine Violet
PolyShine Yellow
PolyShine Orange

The substance causes the change of color by light. When it is exposed to ultraviolet rays (sunlight), the structure of photochromic molecules reversibly changes, and thus the change of color occurs.

It is mainly used for plastic and textile processing. Five colors are available for sales, and we export to USA, Taiwan, China, Japan and other countries.

APPLICATION

Textile, Coating,
Plastic Injection,
Supplies, Ink

Application examples

SUITABLE POLYMER

PP, PE, PVC

Hydrochromic Ink

PRODUCT

Irreversible HCI
Reversible HCI

It is Ink that changes color or its' color disappears when exposed to water. There are two types of Hydrochomic Inks.
- Irreversible : Color changes or disappears when wet.
- Reversible : White to Transparent when wet and back to White when dry.

* White hides underlying image when dried, and the image is revealed when wet

Irreversible HCI

APPLICATION

Diaper,
Moisture Absorber, etc

Color -> Transparent

Black, Blue, Red, Green
Orange, RoseRed

Color -> Color

Yellow → Blue

Irreversible HCI VS. Reversible HCI

Classificaton	Irreversible Hydrochromic Ink	Reversible Hydrochromic Ink
Appearance	Colored oil-based ink	White water-based ink
Solid Content	18 ± 2%	40 ± 5%
Solvent Included	Methanol, Acetone, IPA	Water
Viscosity	18 ± 2 Sec (Zhan #2)	20,000-30,000cps

Reversible HCI

APPLICATION

Stationery, Toys,
Umbrellas,
Swimming Suits,
Diving Suits,etc

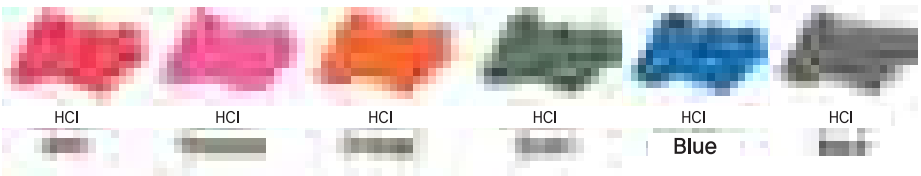
COLOR

White ↔ Transparent

Principle of Color Change

Irreversible Hydrochromic Ink changes from color to color, or color to transparent when exposed to water. Reversible Hydrochromic Ink changes from White to transparent reversibly, and it gives a hiding effect on the background image when dry, and it reveals the underlying image when wet.

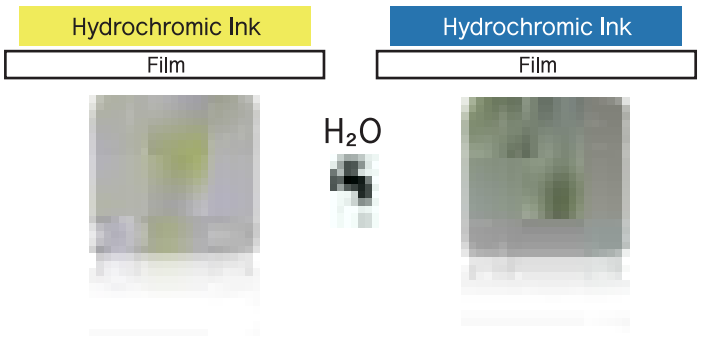
Irreversible Hydrochromic Ink Color Code



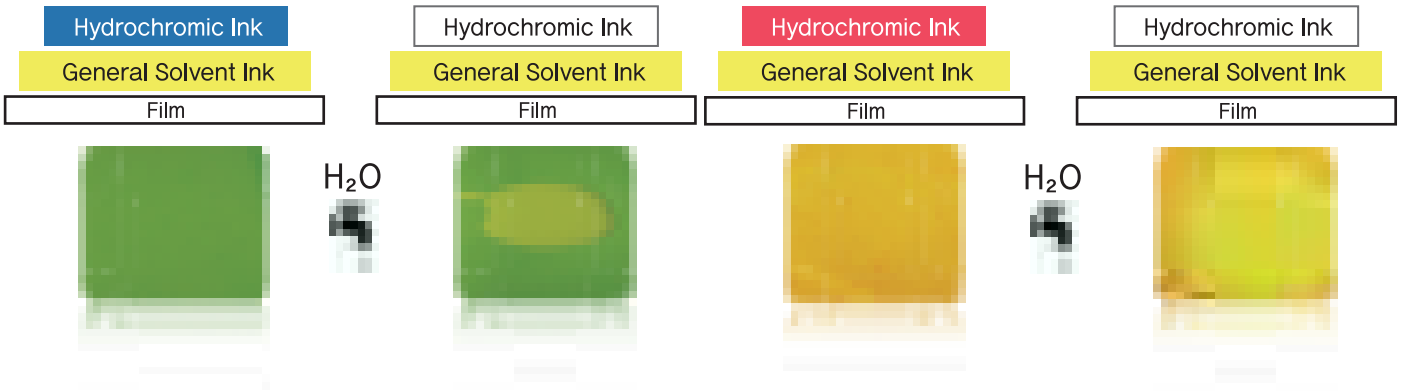
Printing Process	Gravure Printing
Printing Speed	100m/min
Gravure Sylinder	190lpi*

*lpi: line per inch

Single Printing Color-Changing Type



Double Printing Color-Disappearing Type



Features

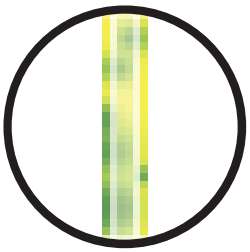
Irreversible Hydrochromic Ink

+ Mainly used for Gravure printing ink
+ Could be applicable to printing on HDPE/LDPE, PET film

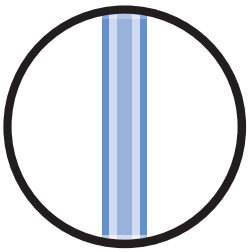
Reversible Hydrochromic Ink

+ Used as silk screen printing ink on paper, fabric, film, etc
+ When opened to use, add minimum amount of water when needed only and stir well
+ 120˚C for 5~10minutes recommened for curing

Application examples
: Irreversible Hydrochromic Ink

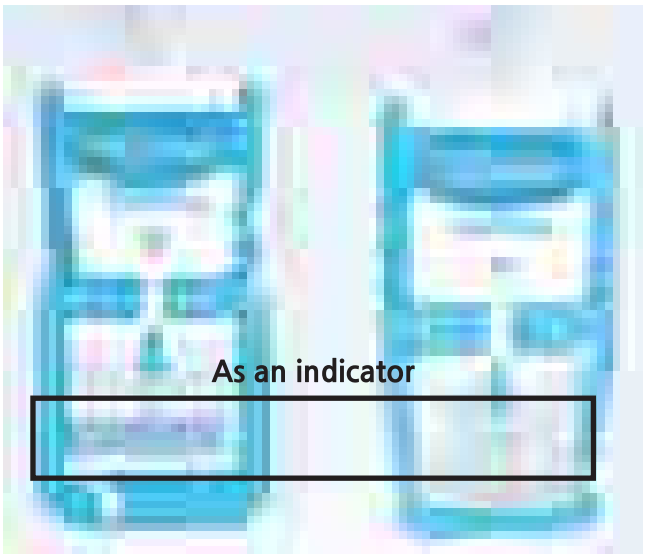


Turned partially green due to moisture



Turned completely blue when babies peed

Durability Test	General Hydrochromic Ink	Insilico Hydrochromic Ink
High temperature and humidity Test (40℃/40%)	5 Days	8 Days
High temperature and humidity Test (40℃/60%)	3 H	5 H
Light fastness	120 H	200H



Wave image disappears when the bottom pocket is filled with water indicating the timing of change

Application examples
: Reversible Hydrochromic Ink

When dry

When wet

When dry

When wet

Aroma Microcapsule

PRODUCT

Powder(Oil-based)
AromaBall P-Series

Slurry(Water-based)
AromaBall S-Series

APPLICATION

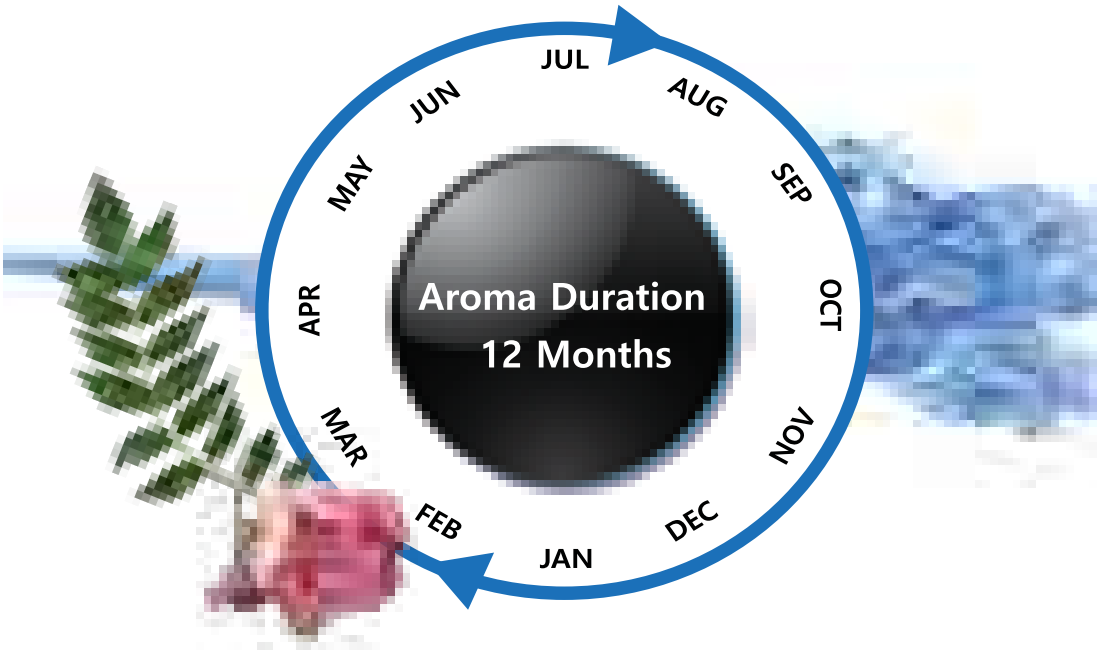
Textile, Coating,
Plastic Injection,
Paper, Stationary,
Film(with perfume)

AROMA

Acacia
Apple
Banana
Cherry
Chocolate
Cinnamon
Eucalyptus
Freesia
Grape
Greentea
Hazelnut
Jasmine
Lavender
Lemon
Mint
OUD
Peppermint
Pine
Pineapple
Rose
Rosemary
Strawberry
Wild Flower
Phytoncide

AromaBall is a product created in the process of making fat-soluble liquid aroma micro-encapsulated to increase scent durability.

By solidifying the liquid aroma, you can use it in various types for your purpose. The particle size, scent durability, and other properties of matter can be adjusted according to purpose of use.



Features

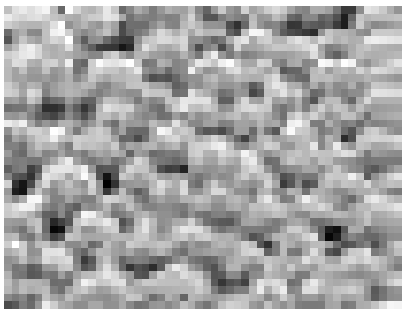
+ Aroma duration effect by encapsulating fragrance oil
+ Release of 20% of scent in natural state
+ More than one year of aroma duration in natural state
+ Release of 90% of scent in moving and minor friction
+ Scent-lasting even after 50 times of washing (certified by KOTITI)
  - in the case of cotton pre-processing
+ Aromatherapy effect
+ Antibacterial, anti-insect and deodorization effect by cypress scent (Phytoncide)

Aromatherapy

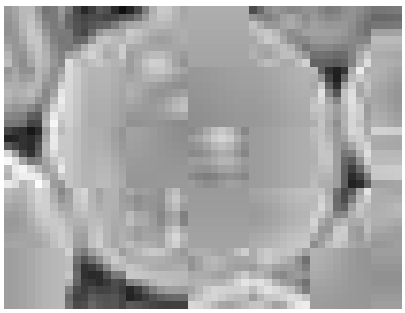
Aromatherapy is a sort of therapy to cure psychological and physical diseases with the use of plant aroma oil.

When around 1~2% of slurry is fixed into textile, scent can last long from capsule. Therefore, by wearing such a textile product, you can enjoy aromatherapy effect of the natural scent.

Aroma Microcapsule by SEM



Aroma Microcapsule
(x10,000)



Aroma Microcapsule
(x25,000)

Vitamin E Microcapsule

PRODUCT

Powder(Oil-based)
BioBall P-Series

Slurry(Water-based)
BioBall S-Series

APPLICATION

Textile, Coating

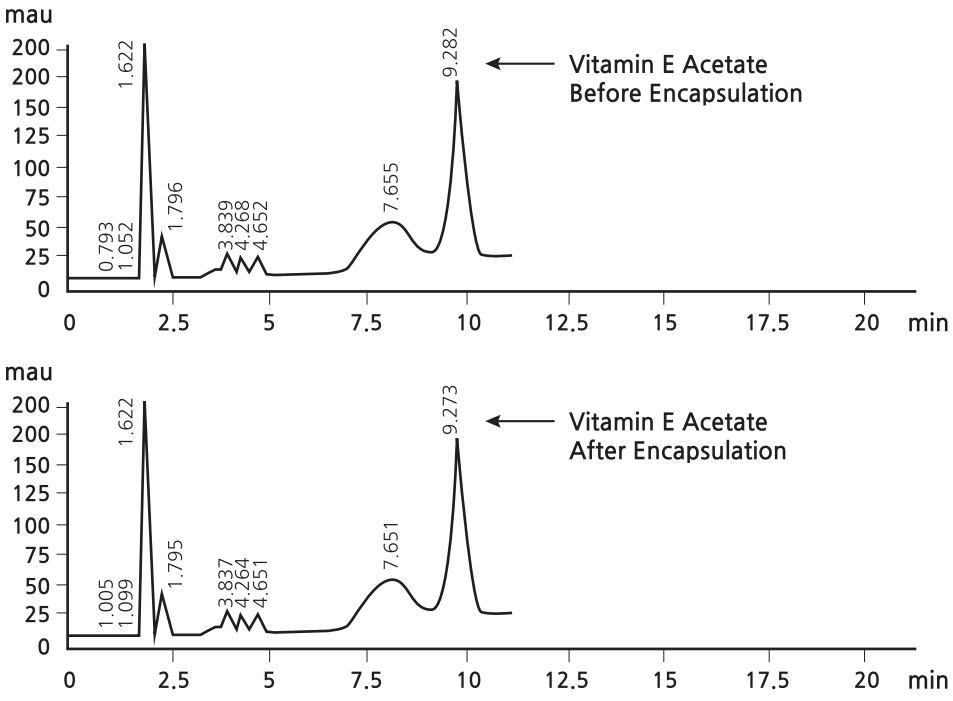
Vitamins are essential for beauty and physical health. **BioBall** was developed in the way of applying microcapsule technology to vitamins.

When **BioBall** is fixed into the textile products which directly contacts skin, such as underwear, stockings, and socks, its microcapsule is blown off by skin friction, and consequently vitamins get absorbed into skin.

Efficacy of Vitamin E

BioBall Vitamin E was developed by the application of microcapsule technology in order to keep vitamin E effective. When people put on the textile product with **BioBall Vitamin E**, they have vitamin E absorbed into skin during daily activity. Therefore, it can bring about more effect of natural synthesis with skin. Vitamin E is effective for anti-aging and skin moisturizing.

HPLC Analysis of Vitamin E Acetate



* Squalen as well as Vitamin E at the peak.

Thermal Storage Microcapsule

PRODUCT

Hot Weather
ThermoBall 35

Four Seasons
ThermoBall 28

Cool Winter
ThermoBall 18

APPLICATION

Textile

TEST REPORT

DIN Mark
from German

ThermoBall is a microcapsule product that contains phase change material, PCM*. The functional product absorbs heat as surrounding temperature goes up, and slow releases it as the temperature goes down.

When the product is applied to clothes, the thermal storage microcapsule makes it phase changed by the temperature change in the external environment and skin to cause heat absorption or heat release.

Such action is employed to give cooling and warming effects on the human body and thereby improve a wearer's thermal freshness.

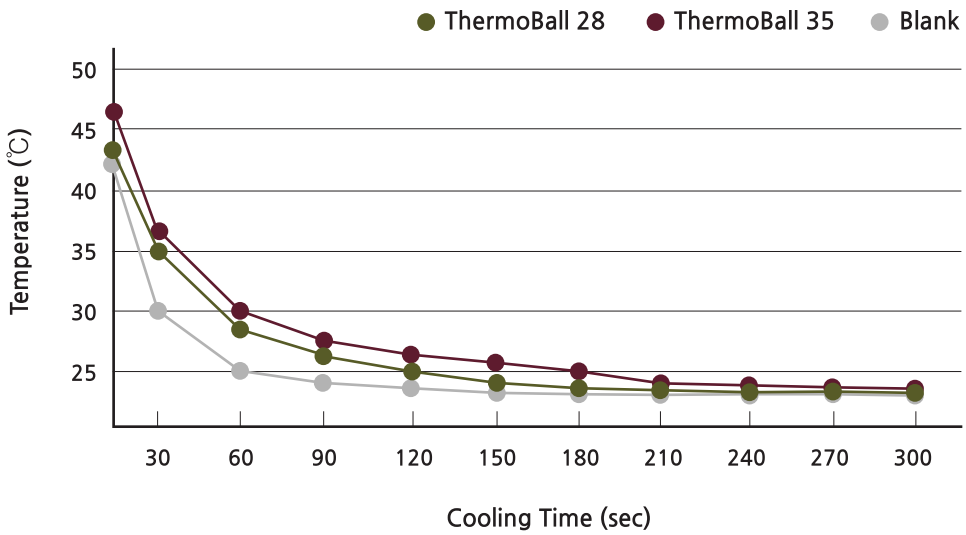
***What is PCM?** PCM stands for Phase Change Material. It means a material whose phase change causes heat absorption and heat release according to the change of the external temperature.

Measurement by Infrared Thermal Camera

+ **Blank Paper**: General copy paper
+ **Coating Thickness**: 25μm
+ **Measurement Method**: Sample coated with thermal storage microcapsule and blank sample are heated 10 minutes in the 70℃ oven. After that, they are measured by an infrared thermal camera.

Blank / ThermoBall 31

Thermal Storage Graph of ThermoBall Series



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With excellent technology and quality, we manufacture new functional microcapsules.

Insilico is a high-value chemical company that develops and produces new materials at a low-cost and high-performance on the basis of fusion technology of chemistry and IT and also develops related software and provides consulting services. We realizes a new innovation of epoch-making cooperation environment in the entire processes from material designing by molecular modeling, laboratory, manufacturing to quality control. As R&D-oriented company to develop new fields, we are actively involved in the development of materials of advanced concept and high technology on the basis of "excellent human resources" and "stable organization". Based on our technology that has been accumulated through consistent investment and R&D and superior product quality, we are preoccupying both domestic and overseas functional microcapsule product market. Recently, we have succeeded in developing an environment-friendly and fluorine-free textile water repellent and expanding our markets. For more information, visit **www.insilico.co.kr/chemical**