Shinceramic Catalogue

Ongiaze Color / Glass Enamels / Ceramic Pastes

SHINCERAMIC CO., LTD.

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ISO 9001 / ISO 14001

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SHINCERAMIC CO., LTD.

Greetings

Our principal manufacturing products are Functional Ceramic Materials using glass frits such as Glass colors, Onglaze colors, and Electronic materials etc., Establishment in 1974, since the localization, under our steady accumulation of R & D and technology, We have been supplying our products to overseas markets as well as the domestic market. domestic market based on steady R & D and technical Know-How accumulated in the meantime since the establishment in 1974. In addition, we are concentrating our all efforts on customer's demands under the development of the new products and specialization of manufactured products.

Management Policies

- Think with customers and pursue the changes
- Cope with environment changes and show the creativity
- Establish the self realization and worth through organization
- Follow the rules for continuous improvement of environment

History

1974 : Established Shinheung Ceramic Company in Bucheon city, Gyeonggi-do
: Developed & manufactured the glass enamels for low & middle temperature

1975 : Developed & manufactured the glass enamels for high temperature

1976 : Developed & manufactured the onglaze colors

1979 : Corporate changed "Shinheung Ceramic Industry Co., Ltd."

1984 : New built & moved to Banwol industrial complex in Ansan city

1987 : Developed & manufactured the Silver Conductor Paste for automobile glass

1992 : Developed & manufactured the Sealing Glass for magnetic head
: Awarded the first prize for '92 Industrial development

1993 : New built & moved to Sihwa industrial complex in Ansan city

1996 : Developed & manufactured the Solder Glass for electronic parts

1998 : Developed & manufactured the U.V. Color paste
: Developed & manufactured the Onglaze colors of lead & cadmium free

1999 : Obtained the ISO 9001 certificate

2000 : Obtained the patent No. 0276459 on thermoplastic color form device for glass printing

2002 : Established "Shinceramic Research Institute"
: Obtained the ISO 14001 certificate
: Firm name changed as "Shinceramic Co., Ltd."
: Developed & manufactured the Lead Free Black Enamel for automobile glass

2004 : Appointed as a "INNO-BIZ (enterprise for Technical Innovation Type)"
: Appointed as a "Expert Enterprise for Parts & Materials"

2005 : Developed & manufactured the Silver Hiding Black Enamel for automobile glass

2007 : Developed Non-aqueous EDLC(Electronic Double Layer Capacitor)

2010 : Developed & manufactured "ING Ink"
: Developed & manufactured "PAD Ink"
: Awarded $ 3 million dollar export from Korea International Trade Association

2011 : Developed "Gravure printing roll technology"
: Developed & manufactured "Echo-friendly ink for Low-temperature curing and sintering"

2012 : Developed & manufactured "Reflective Ink (Gold & Silver)"
: Developed & manufactured "Ink for heat-resistant glass"
: Developed & manufactured "Etching Ink"

Product Category

1 Onglaze colors

1.1 6000,26000series Onglaze colors(740~890℃) – Unleaded
1.2 3000,23000series Onglaze colors(730~870℃) – Leaded

2 Glass colors

2.1 24000, 4000series colors(640~720℃) – Architectural glass. Tempered glass
2.2 25000, 5000series colors (610~650℃) – Returnable beverage bottle
2.3 7000series colors(570 ~ 630℃) – Glass dish, Tumbler
2.4 37000series colors(580 ~ 640℃) – Hard glass, Low expansion glass
2.5 SR27000, SR7000series colors(560 ~ 620℃) – Glass cup, Cosmetic bottle
2.6 8000series colors(520 ~ 560℃) – Lightening glass, One–way glass

3 Ceramic pastes for Automotive window glass

4 Inorganic pigments

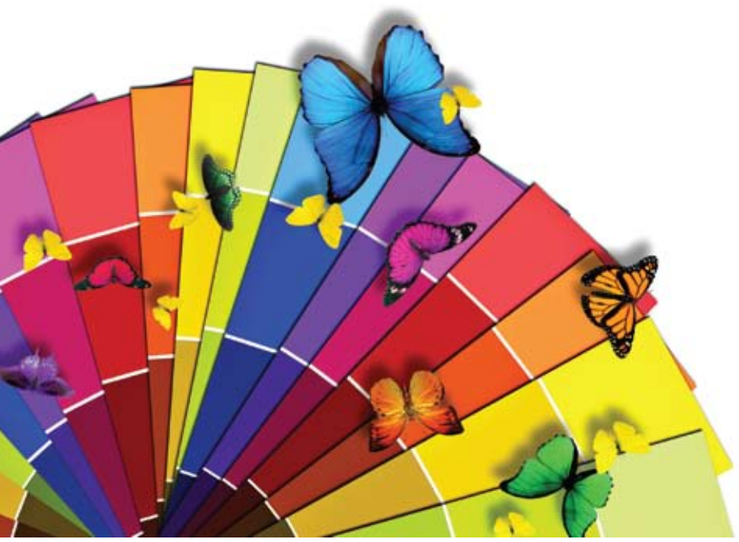
5 Glass frits for function

6 Mediums

6.1 Mediums for Indirect printing
6.2 Mediums for Direct printing

7 New Products

8 Reference



Onglaze Colors

Onglaze colors that consist of powdered frits and inorganic pigments mixed technically are used for decoration of the glazed surface of calcined ceramic wares such as Earthen ware, Porcelain, Bone china, Stone ware, tiles and etc., It is decorated with color relatively at low temperature. Frits react with the surface of the glaze and fix the desired printing colors on the glaze at the softening point. So, if the firing temperature were high, you may think that the coloration has high durability. But, in case of a dinnerware decoration, the cleaning process is required therefore it must be checked not only the alkali resistance in the cleaning solution but also the mechanical durability such as the friction and the wearing. Currently, we produce different onglaze colors, i.e.. 3000, 23000 series colors for leaded type and 6000, 26000 series colors for unleaded type.

1.1 Onglaze colors(Unleaded & Leaded)

- Onglaze colors are detected in extremely small quantities of heavy metals by a strong chemical resistance and these colors are stabilized with various colors and wide firing ranges.
- These colors are divided into 'Unleaded type' and 'Leaded type', as an unleaded type, 6000 series and 26000series are produced separately. And, as a leaded type, 3000 series and 23000 series are produced separately. And also, according to the type of the ware, used by selecting the optimal Onglaze colors.

1.1.1 Application

- Onglaze colors are used mainly for decoration of the glazed surface of calcined porcelain A general working procedure is the same as the following.

(★: Step of using Onglaze colors)

- A decoration of onglaze colors is normally applied for decal transfer method and it is possible to be used by Dipping, Spraying, and Hand painting method etc.,
  In case of Ceramic wares, it is possible to be applied to Porcelain, Bone china, Vitreous china, Earthen ware and Stone ware etc.,

- Generally, the coefficient of thermal expansion (C.T.E.) of the Glaze is 60 ~ 85 X 10^{-7}/℃
  However, as the glaze of low coefficient expansion is 40~45 X 10^{-7}/℃, in case of being applied to the corresponding ware, If the printing thickness is over 25㎛, it is possible to happen Cracking or Crazing.

1.1.2 Firing

	Application	Firing Temperature(℃)	Coefficient of thermal expansion C.T.E(x 10^{-7}/℃)	Remark
6000 Series	Porcelain	800 ~ 880℃	60 ~ 70	Unleaded
	Bone China	800 ~ 860℃		
	Earthenware	780 ~ 850℃		
26000 Series	Bone China	840 ~ 890℃	75 ~ 85	
	Earthenware	740 ~ 810℃		
3000 Series	Porcelain	780 ~ 850℃	70 ~ 80	Leaded
	Bone China	750 ~ 830℃		
	Earthenware	730 ~ 800℃		
23000 Series	Porcelain	800 ~ 870℃		
	Bone China	780 ~ 850℃		
	Earthenware	760 ~ 830℃		

1.1.3 Particle size

10⁺㎛	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	1⁻㎛	23.68%

Average particle size : 3~4㎛
CILAS 1064 Liquid

1.1.4 Choice of screen

- Color : Polyester screen 90 ~ 140T Threads/㎝(230 ~ 355mesh/inch)
- Flux : Polyester screen 100 ~ 120T Threads/㎝(255 ~ 305mesh/inch)

1.1.5 Mixing ratio between Powder and Oil

Powder form color : Oil	10 : 7 ~ 11
Cover coating flux : Oil	10 : 7 ~ 11

1.1.6 General Miscibility

※Unleaded Onglaze colors

- In case of mixing Iron red 26104 and Cobalt blue 26505 to the other class colors, it must need a pre-test.
- Mixing white 26301 keeps bright and transparent of a color. And it is stable to mix with large quantity.
- Gold class colors : There are 26001, 26002 etc as pink class color and 26506 as Purple Blue.
- Cover coating flux does increase the stability of color and the gloss of surface.
  There are 6966 of 6000series and 26901 of 26000series.

※Leaded Onglaze colors

- Cadmium class colors
  3155, 3130, 3182, 3241, 3425(23101, 23102, 23103, 23201, 23401) are mixable each other But, in case of mixing a normal class colors, it must need a pre-test.
- Normal class colors
  In case of mixing Iron red 3140(23104) and Cobalt blue 3589(23505) to the other class colors, it must need a pre-test.
  Mixing White 3366 is applicable to Cadmium class colors and Normal class colors.
  It keeps bright and transparent of a color. And it is stable to mix with large quantity.
  Opaque White 3326(23303) does not become yellowish at high temperature Or, it is not discolored by normal class colors such as Cobalt Blue.
  But, if it should be printed over Cadmium class colors, you need to print it thick.
  So, in case of over 830℃, the Cadmium class colors can become discolored or discoloration.
- Gold class colors
  There are 0360, 0130(23001, 23002) etc as Pink class color and 3562(23506) as Purple Blue.

1.1.7 Drying conditions

- All powder form colors are controlled under 0.8% moisture content.
  As long-term storage in high humidity, if its moisture content goes up above 0.8%,
  we recommend you using it after drying.

1.1.8 4 Color

Product code			Color	Screen
3000series	6000series	26000series		
SF01(23040)	0660	26040	Magenta	140T(Threads/㎝) 355mesh/inch
SF25(23240)	6231	26240	Yellow	
SF58(23540)	6537	26540	Cyan	
SF77(23740)	6737	26740	Black	
3955(23901)	6966	26901	Cover coating flux	120T(305mesh/inch)

1.1.9 Chemical resistance

- Onglaze colors are detected in extremely small quantities of heavy metals by a strong chemical resistance Especially, if used a cover coating flux, it is possible to increase the gloss and minimize the detection of the heavy metal.
  Onglaze colors satisfy the following test conditions.
- Test for the detection of the heavy metal (ASTM C738-94 & AOAC 15th.Ed. Section 937.32) The test sample is filled with 4% acetic acid solution and then left to stand 24hours in complete darkness, under the controlled environment of 22±2 Degree Centigrade.
- Detergent resistance test
  The test sample is filled with 0.5% Calgonite of 77 Degree Centigrade and left to stand 24hours. And then it must leave no marks.

FDA standard of Onglaze colors(Unleaded)

※ASTM C738-94(4% acetic acid, 22±2℃, 24 hours)

Shape	Notes	Limits(㎍/㎖)	
		Pb (Ref 1)	Cd (Ref 2)
Flatware(Plates) (Internal depth(≤25mm))	(average of 6 units)	3.0	0.50
Small Hollowware(Bowls) (Volume < 1.1ℓ)	(any one of 6 units)	2.0	0.50
Large Hollowware(Serving dishes) (Volume ≥ 1.1ℓ)	(any one of 6 units)	1.0	0.25
Cups and Mugs Standard	(any one of 6 units)	0.5	-
Pitchers(Volume ≥ 1.1ℓ) Standard	(any one of 6 units)	0.5	-

Reference 1 : FDA Compliance Policy 7117.07, 12/12/95
Pottery(Ceramics); Imported and Domestic
- Lead Contamination

Reference 2 : FDA Compliance Guide 7117.06, 12/12/95
Pottery(Ceramics); Imported and Domestic
- Cadmium Contamination

Proposition 65, California's Safe Drinking Water & Toxic Enforcement Act

※4% acetic acid, 22±2℃, 24 hours

Shape	Notes	Limits(㎍/㎖)	
		Pb	Cd
Flatware(Plates)		0.226	0.316
State Detection Limit		0.1	0.322
Small Hollowware(Bowls)		0.1	0.322
Large Hollowware, Cooking/Storage		0.1	0.322
Large Hollowware, others		0.1	0.084

1.1.10 Color list

Product							Color
6000	PANTONE	26000	PANTONE	3000	23000	PANTONE	
0660	208C	26001	208C	0360	23001	216C	Purple Pink
0620	217C	26002	217C	0130	23002	204C	Pink
				3155	23101		Dark Red
				3130	23102	185C	Red
				3182	23103	021C	Red Orange
6140	181C	26104	181C	3140	23104	174C	Iron Red
6149	196C	26105	196C	3149	23105	196C	Pink Red
				3241	23201	107C	Yellow
6231	3935C	26202	100C	3232	23202	100C	Light Yellow
6245	1225C	26203	130C	3245	23203	136C	Pumpkin Yellow
6313		26301		3313	23301		Mixing White
6326		26303		3326	23303		Opaque White
6315		26304		3315	23304		Relief White
		36401	369C	3425	23401	369C	Yellow Green
6412	364C						Green
6471	360C	26402	362C	3471	23402	363C	Grass Green
6470	3288C	26403	3285C	3470-A	23403	3285C	Peacock Green
				3491	23404	364C	Olive Green
6476	3415C	26405	3298C				Dark Green
6486	328C	26406	320C	3486	23406	320C	Blue Green
6536	308C	26501	307C	3536	23501	3015C	Turquoise Blue
6511	298C	26502	2985C	3511	23502	2985C	Sky Blue
6547	2718C	26503	285C	3547	23503	2716C	Blue
		26504	2718C	3540		2718C	Salvia Blue
6589	2728C	26505	2728C	3589	23505	2728C	Cobalt Blue
				3562	23506	2725C	Purple Blue
		26507	315C	3537	23507	314C	Turquoise Blue
6656	1355C	26601	1355C	3656	23601	1355C	Light Brown
6670	470C	26602	1685C	3670	23602	1685C	Red Brown
6620	4695C			3620		168C	Dark Brown
6737		26701		3737	23701		Black
6783	649C	26702		3783	23702	428C	Gray
6966		26901		3955	23901		Cover Coating Flux
6000		26902		3000	23902		Mixing Flux
4 Color							
0660	208C	26040	208C	SF01	23040	216C	Magenta
6231	3935C	26240	106C	SF25	23240	106C	Yellow
6537	314C	26540	299C	SF58	23540	299C	Cyan Blue
6737		26740		SF77	23740		Black

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

Glass colors

Glass colors are used for the decoration of glass wares such as bottles, tumbler and construction glass etc.
These are not a colored glass but a material of the design applied on the surface of the glass wares.
And these are bonded by firing.
Glass colors consist of the glass frit (ca. 70 - 90 %) with a low fusing point and the color stain (ca. 10 - 30 %)
The most important characteristics of the glass color is its resistance to slightly acidic or alkaline washing.
And, between the fired and boned planes, no stress should happen. This stress can happen due to the discord of a coefficient of thermal expansion (C.T.E.) between the base and the using color.
Generally, the C.T.E. of coating color should be 3 x 10-7/ °c lower than that of the glass base.
Note here the C.T.E of the applying color must never be higher than that of the bottom glass.
Another cause of stress between the fired planes is that Ion from glass color frit spreads and penetrates to the bottom glass.
For example, a lithium in glass colors can be diffused readily into the substrate glass that does not contain a lithium.
This diffusion can cause a major change in the C.T.E. of the substrate and create an unfavorable or even disastrous interfacial stress.

The kinds and the details of Glass color

Glass has different C.T.E.(Coefficient of thermal expansion) depending on the composition of the glass.
And also it has the different softening temperature according to the form and the quality of a ware.
Therefore, we are manufacturing hereabouts applicable glass color according to an usage.

Series and color	Firing temperature(℃)	C.T.E(10^{-7}/℃)	Acid resistance	Alkaline resistance	Hydrogen sulfide resistance	Application
24000series (Unleaded)	640 ~ 720	75~85 X 10^{-7}/℃	B^-	B^-	B^-	Architectural glass
4000series			A	A	A	Tempered glass
25000series (Unleaded)	610 ~ 650	80~90 X 10^{-7}/℃	A^-	A^-	A^-	Glass bottle / Returnable beverage bottle
5000series			A	A	A	
7000series	570 ~ 630	70~85 X 10^{-7}/℃	B^+	B^+	B^+	Glass dish wares/Hard glass
37000series	580 ~ 640	50~60 X 10^{-7}/℃	B	B	B	Hard glass/Low expansion glass
SR27000series (Unleaded)	560 ~ 620	80~90 X 10^{-7}/℃	C	C	C	Glass cup/Cosmetic bottle
SR7000series			C	C	C	
8000series	520 ~ 560	80~85 X 10^{-7}/℃	D	D	D	Lightening glass/One-way glass

2.1 24000, 4000series color(640 ~ 720℃)

2.1.1 Application

- Classified 24000series(Unleaded) and 4000 series(Leaded), generally, after processing a flat glass, printed on it and tempered.
  these are applied to Architectural glass, Tempered glass and a safety glass of home appliances like a microwave oven etc.,
- A color for Spandrel glass : By the development of a method of construction, the present structure generally compose all exterior walls of glass plates and the exterior wall is divided into a window and a floor(= a spandrel).
  This part between a window and a floor is never exposed and also a place that is accumulated by a solar heat differently with a transparent window.
  A glass color of 4000series for Architectural glass raise a grade of a structure by supplying with an elegant and an antique color and also because this color has a strong chemical resistance, the durability of a glass become excellent.
- Also, we are manufacturing many products : Frost color, Metallic color and etc., for 'Interior design', Construction decoration'
  By a decoration color on a safety glass for home appliances : Microwave oven, Oven door, Grill door, and Refrigerator etc., our glass color is used widely.
  This safety glass is a kind of tempered glass that makes strengthened a heating shock or a mechanical intensity on a surface of glass treated with a compressive strains by cooling the surface with a cool air under the conditions that the thickness of a glass plate is 3 to 12mm, the heating temperature is 640 to 720℃.

2.1.2 Product's Form

- Generally, we are supplying the goods as the paste form mixed with Glass color powder and medium.

2.1.3 Particle Size

$10^+\mu m$	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	$1^-\mu m$	23.68%

Avg. particle size : 3~4㎛ CILAS 1064 Liquid

2.1.4 Printing Room Conditions

- On a screen printing, it is very important that the printing environment must keep clean.
  That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

2.1.5 Viscosity Control

- Powder form is easy to absorb moisture. So, it must be kept well in little moisture.
  Before using it, we recommend drying it by about 130℃.
- In case of Paste form, because the first supplying viscosity is 100 ~ 500ps(Rion(VT-04)/24℃), Please mix the supplier's recommended medium with 1 ~ 3% and then, in case of a printing machine, keep the viscosity as 180±20ps(Rion(VT-04)/24℃).
  In case of a manual printing, keep the viscosity as 100~150ps±(Rion(VT-04)/24℃).

2.1.6 Choice of Screen

- The quality of the material : Nylon, Polyester, Stainless steel screen
  Mesh : 61 ~ 120T (Threads/㎝)
  155 ~ 305mesh/inch

2.1.7 Printing Thickness
- During a printing work, a worker must control the printing thickness at any time and keep the thickness 22 ~ 30㎛.

2.1.8 Drying Conditions
- IR type : over 3minutes under 130 ~ 180℃
- UV ink type : Accumulated Intensity of Radiation(A.I.R) 1,400mj/㎠

2.1.09 Firing Temperature
- Normal Firing : 640 ~ 680℃
- Conditions for Tempering : 680 ~ 720℃

2.1.10 Color List

Code		Color	PANTONE
Unleaded	Leaded		
24101	4101	Red(Cd bearing)	1805C
24201	4201	Yellow(Cd bearing)	012C
24310	4310	White	
24331	4331	Super White(cool)	
24340	4340	Super White(warm)	
24395	4395	Frost White	
24434	4434	Blue Green	7720C
24469	4469	Green	7727C
24530	4500A	Blue	293C
24563-3	4563-3	Dark Blue	2965C
24548	4548	Cobalt Blue	286C
24603	4603	Choco.Brown	7595C
24620	4620	Brown	7566C
24705	4705-78	Black	
24370	4370	Grey	5435C
M24001	M4001	Metallic Silver	
M24009	M4009	Metallic Gold	
M24008	M4008	Metallic Copper	

4 Color				
Code		Color	Screen	PANTONE
24101	4101S	Red	140T(Threads/㎝) 355mesh/inch	1805C
24201	4201S	Yellow		012C
24506	4506	Cyan		301C
24730	4701	Black		
24340R	4340	Masking white	100T(255mesh/inch)	

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

2.2 25000, 5000series colors(610 ~ 650℃)

2.2.1 Application
- Classified 25000series(Unleaded) and 5000 series(Leaded), these colors is used for mainly beverage bottle. Especially, the chemical resistance and etc., must be preceded due to a remaking by repeating and collecting a bottle. These colors used for a label of International beverage bottle meet the strict standard requirements.

2.2.2 Product's Form
- Generally, mixed a glass color powder with a wax, thermoplastic product are supplied But, according to circumstances, on the first printing or the last printing design, paste form would be used.

2.2.3 Particle Size

10⁺㎛	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	1⁻㎛	23.68%

Avg. particle size : 3~4㎛ CILAS 1064 Liquid

2.2.4 Printing Room Conditions
- On a screen printing, it is very important that the printing environment must keep clean. That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

2.2.5 Viscosity Control
- Powder form is easy to absorb moisture. So, it must be kept well in little moisture. Before using it, we recommend drying it by about 130℃.
- Thermoplastic form becomes supplied the first supplying viscosity with 40 ~ 120ps (Rion(VT-04)/75±5℃). And, according to the screen's temperature, it is used by adding a special medium.
- In case of Paste form, because the first supplying viscosity is 200 ~ 500ps(Rion(VT-04)/24℃), Please mix the supplier's ecommended medium with 1 ~ 3% and then, in case of a printing machine, keep the viscosity as 250±50ps(Rion(VT-4)/24℃). in case of a manual printing, keep the viscosity as 100~150ps±(Rion(VT-04)/24℃).

2.2.6 Lithium contents
- As Li-Free color, 25000series colors minimizes a natural lithium contents under 30ppm.

2.2.7 Choice of Screen
- The quality of the material : Paste form : Nylon, Polyester, Stainless steel screen Thermoplastic form : Stainless steel screen(60 ~ 80℃)
- Mesh : 65 ~ 100T Threads/㎝ 165 ~ 255mesh/inch

2.2.8 Drying condition
- Paste type : Over 3minutes under 130 ~ 180℃
- Thermoplastic type : there is no need to dry.

2.2.9 Firing temperature
- Normal firing : 610 ~ 650℃

2.2.10 Color List

Code		Color	Code		Color
Unleaded	Leaded		Unleaded	Leaded	
	5140-1	Sosro orange	25407	5407	Mirinda green
25105Cd bearing	5105	Coke red	25424	5420	Fanta green
25107Cd bearing	5107	Pepsi red	25445	5445	Tekita green
25230Cd bearing	5204-2	Yellow	25450	5450	Crush green
25225B	5223	Sprite yellow	25522	5522	Pepsi blue
25212B	5233	Tekita yellow	25533-2	5533-1	RC blue
25380	5380	White	25527	5527	Fanta blue
	5382	Frost White			

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

2.3 7000series colors(570 ~ 630℃)

2.3.1 Application

- As a color usable to the kinds of glass dish and used for an opal glass, a glass tube for a medicine instrument (α = 35 ~ 55 X 10-7/K) the acid resistance and the alkali resistance is the average.
  The decoration of 7000series is used for Decal transfer, Direct printing, Dipping, Spraying, Hand painting and etc.,

2.3.2 Product's Form

- 7000series is supplied with powder, paste and thermoplastic form.

2.3.3 Particle Size

10⁺㎛	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	1⁻㎛	23.68%

Avg. particle size : 3~4㎛ CILAS 1064 Liquid

2.3.4 Printing Room Conditions

- On a screen printing, it is very important that the printing environment must keep clean.
  That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

2.3.5 Viscosity Control

- Powder form is easy to absorb moisture. So, it must be kept well in little moisture.
  Before using it, we recommend drying it by about 130℃.
- Thermoplastic form becomes supplied the first supplying viscosity with 40 ~ 120㎰ (Rion(VT-04)/75±5℃). And, according to the screen's temperature, it is used by adding a special medium.
- In case of Paste form, because the first supplying viscosity is 200 ~ 500㎰(Rion(VT-04)/24℃), Please mix the supplier's recommended medium with 1 ~ 3% and then, in case of a printing machine, keep the viscosity as 180±20㎰(Rion(VT-04)/24℃). in case of a manual printing, keep the viscosity as 100~150㎰±(Rion(VT-04)/24℃).

2.3.6 Choice of Screen

- The quality of the material : Paste form : Nylon, Polyester, Stainless steel screen
  Thermoplastic form : Stainless steel screen(60 ~ 80℃)
- Mesh : 65 ~ 120T Threads/㎝
  165 ~ 305mesh/inch

2.3.7 Drying conditions

- Paste type : Over 3minutes under 130 ~ 180℃
- Thermoplastic type : there is no need to dry.

2.3.8 Firing temperature

- Normal firing : 570 ~ 630℃

2.3.9 Color List

Code	Color	PANTONE	Code	Color	PANTONE
7101	Red	186C	7506	Cyan	302C
7102	Red orange	021C	7512	Blue	285C
7110	Maroon	1817C	7521	Sky blue	2915C
7167	Orange	1505C	7522	Blue	286C
7188	Pink	701C	7526	Sky blue	299C
7201	Yellow	109C	7534	Blue	285C
7202	Yellow	107C	7536	Turquoise blue	308C
7380	White		7548	Cobalt blue	2738C
7395	Frost		7571A	Dark blue	514C
7411	Light green	3258C	7620	Choco. Brown	1545C
7422	Yellow green	370C	7639	Light brown	1675C
7463	Grass green	348C	7649	Brown	168C
7465-2	Green	356C	7701	Black	
7468	Blue green	322C	7783	Gray	Cool gray 9C
7469	Deep green	349C	7000	Mixing Flux	

4 Color

Code	Color	Screen	PANTONE
7101	Red	140T Threads/㎝ 355mesh/inch	186C
7201	Yellow		109C
7202	Yellow		107C
7506	Cyan		302C
7536	Cyan		308C
7701	Black		
7000	Mixing flux		
7380	Masking white	100T(255mesh/inch)	

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

2.4 37000series colors(580 ~ 640℃)

2.4.1 Application

- It is usable to the decoration of glass dishware.
- It is suitable to the decoration of low expansion borosilicate glasses like Acropal and pharmaceutical be(α=35~55x10-7/℃)
- The decoration of 37000series is used for Decal transfer, Direct printing, Dipping, Spraying, Hand painting and etc.,
- This is similar to 7000series.

2.5 SR27000, SR7000series colors(560 ~ 620℃)

2.5.1 Application

- Classified SR27000series(Unleaded) and 7000 series(Leaded), it is suitable to the decoration of a soda lime glass like a glass cup, a cosmetic bottle and etc., The decoration is used for Decal transfer, Direct printing, Dipping, Spraying, Hand painting and etc.,

2.5.2 Product's Form

- These series are supplied with powder, paste and thermoplastic form

2.5.3 Particle Size

10~5㎛	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	1㎛	23.68%

Avg. particle size : 3~4㎛ CILAS 1064 Liquid

2.5.4 Printing Room Conditions

- On a screen printing, it is very important that the printing environment must keep clean.
  That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

2.5.5 Viscosity Control

- Powder form is easy to absorb moisture. So, it must be kept well in little moisture.
  Before using it, we recommend drying it by about 130℃.
- Thermoplastic form becomes supplied the first supplying viscosity with 40 ~ 120ps (Rion(VT-04)/75±5℃). And, according to the screen's temperature, it is used by adding a special medium.
- In case of Paste form, because the first supplying viscosity is 200 ~ 500ps(Rion(VT-04)/24℃), Please mix the supplier's recommended medium with 1 ~ 3% and then, in case of a printing machine, keep the viscosity as 180±20ps(Rion(VT-04)/24℃). in case of a manual printing, keep the viscosity as 100~150ps±(Rion(VT-04)/24℃).

2.5.6 Choice of Screen

- The quality of the material : Paste form : Nylon, Polyester, Stainless steel screen
  Thermoplastic form : Stainless steel screen(60 ~ 80℃)
- Mesh : 65 ~ 120T Threads/㎝
  165 ~ 305mesh/inch

2.5.7 Drying Conditions

- Paste type : Over 3minutes under 130 ~ 180℃
- Thermoplastic type : there is no need to dry.

2.5.8 Firing Temperature

- Normal firing : 560 ~ 630℃

2.5.9 Color List

Code	Color	PANTONE	Code	Color	PANTONE
SR7101	Red	186C	**SR7506**	Cyan	302C
SR7102	Red orange	021C	**SR7512**	Blue	285C
SR7110	Maroon	1817C	**SR7521**	Sky blue	2915C
SR7167	Orange	1505C	**SR7522**	Royal blue	286C
SR7188	Pink	701C	**SR7526**	Sky blue	299C
SR7201	Yellow	109C	**SR7534**	Blue	285C
SR7202		107C	**SR7536**	Turquoise blue	308C
SR7380	White		**SR7548**	Cobalt blue	2738C
SR7395	Frost		**SR7620**	Choco. Brown	1545C
SR7411	Light green	3258C	**SR7639**	Light brown	1675C
SR7422	Yellow green	370C	**SR7649**	Brown	168C
SR7463	Grass green	348C	**SR7701**	Black	
SR7468	Blue green	322C	**SR7783**	Gray	Cool gray 9C
SR7469	Deep green	349C	**SR7000**	Mixing Flux	

4 Color

Code	Color	Screen	Remark
SR7101	Red	140T Threads/㎝ 355mesh/inch	186C
SR7201	Yellow		109C
SR7202	Yellow		107C
SR7506	Cyan		302C
SR7536	Cyan		308C
SR7701	Black		
SR7000	Mixing flux		
SR7380	Masking white	100T(255mesh/inch)	

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

2.6 8000series colors(520 ~ 560℃)

2.6.1 Application

- As a color applied to a changeful thin glass product or an one-way glass product, it is the lowest firing temperature and applied to the product that the chemical resistance is unimportant.
  The decoration of 8000series is used for Decal transfer, Direct printing, Dipping, Spraying, Hand painting and etc.,

2.6.2 Product's Form

- 8000series is supplied with powder, paste and thermoplastic type form.

2.6.3 Particle Size

10⁺㎛	5.58%	5~1㎛	55.43%
10~5㎛	15.31%	1⁻㎛	23.68%

Avg. particle size : 3~4㎛ CILAS 1064 Liquid

2.6.4 Printing Room Conditions

- On a screen printing, it is very important that the printing environment must keep clean.
  That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

2.6.5 Viscosity Control

- Powder form is easy to absorb moisture. So, it must be kept well in little moisture.
  Before using it, we recommend drying it by about 130℃.
- Thermoplastic form becomes supplied the first supplying viscosity with 40 ~ 120ps (Rion(VT-04)/75±5℃). And, according to the screen's temperature, it is used by adding a special medium.
- In case of Paste form, because the first supplying viscosity is 200 ~ 500ps(Rion(VT-04)/24℃), Please mix the supplier's recommended medium with 1 ~ 3% and then, in case of a printing machine, keep the viscosity as 180±20ps(Rion(VT-04)/24℃). in case of a manual printing, keep the viscosity as 100~150ps±(Rion(VT-04)/24℃).

2.6.6 Choice of Screen

- The quality of the material : Paste form : Nylon, Polyester, Stainless steel screen
  Thermoplastic form : Stainless steel screen(60 ~ 80℃)
- Mesh : 65 ~ 120T Threads/㎝
  165 ~ 305mesh/inch

2.6.7 Drying Conditions

- Paste type : Over 3minutes under 130 ~ 180℃
- Thermoplastic type : there is no need to dry.

2.6.8 Firing Temperature

- Normal firing : 520 ~ 560℃

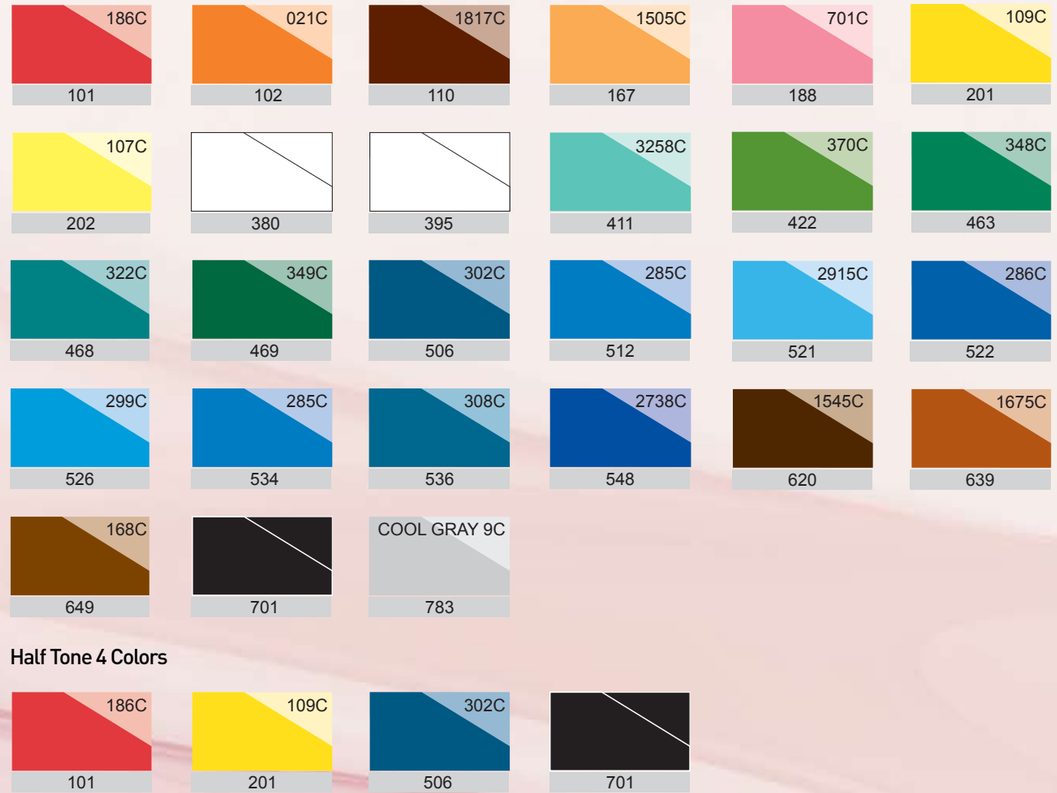
2.6.9 Color List

Code	Color	PANTONE	Code	Color	PANTONE
8101	Red	186C	**8506**	Cyan	302C
8102	Red orange	021C	**8512**	Blue	285C
8110	Maroon	1817C	**8521**	Sky blue	2915C
8167	Orange	1505C	**8522**	Royal blue	286C
8188	Pink	701C	**8534**	Blue	285C
8201	Yellow	109C	**8536**	Turquoise blue	308C
8202	Yellow	107C			
			8548	Cobalt blue	2738C
8380	White		**8571-4**	Dark blue	514C
8395	Frost		**8620**	Choco. Brown	1545C
8411	Light green	3258C	**8639**	Light brown	1675C
8422	Yellow green	370C	**8649**	Brown	168C
8463	Grass green	348C	**8701**	Black	
8468	Blue green	322C	**8783**	Gray	Cool gray 9C
8469	Deep green	349C	**8000**	Mixing flux	

4 Color			
Code	**Color**	**Screen**	**Remark**
8101	Red	140T Threads/㎝ 355mesh/inch	186C
8201	Yellow		109C
8202	Yellow		107C
8506	Cyan		302C
8536	Cyan		308C
8701	Black		
8000	Mixing flux		
8380	Masking white	100T(255mesh/inch)	

※ For a stable and continuous use of Ceramic Colors, it must need a pre-test before obtaining the optimal working conditions.

Basic Color Palette



Half Tone 4 Colors

Ceramic pastes for Automotive window glass

3.1 Application

- Ceramic pastes for Automotive window glass are classified into Black paste and Silver paste for Automotive window glass
- Black paste color for automotive window glass is printed on the glass plate, which will be in the process of softening and tempering at appropriate firing temperature. therefore, according to working process, it is classified and manufactured into two types, i.e., for self weight bending(=Rear window glass) and for laminated glass(=Front windshield). Recently, we are developing and producing a lead free color acceptable environmental issue.
- Silver paste for automotive window glass is designed to be used as the heat line of the front windshield and the rear window glass. It has a good characteristic of heating element by being connected to electricity equipment.

3.2 Kinds of Automotive window glass

- Automotive front windshield(for Laminated glass)
  After putting PVB film between two glass plates of 2.1㎜ or 3.0㎜, and then bound two glass.
  This glass is a safety glass made up for the weak points in an intensity of a normal glass.
  As mainly printing this glass by a black paste, improve a fine sight, prevent ultraviolet rays from passing through the glass, and intercept exposed parts joined with a car body.
  Recently, it would be printed a silver conductor paste for defrosting.
- Automotive rear window(for self weight bending)
  On high temperature, form a normal glass plate of 3.2㎜ ~ 5.0㎜, quenched by a cool air of 40 ~ 50℃ and then a glass made a compressive stress on the glass surface Especially, automotive rear window has not only a heat line printed by a black paste and a silver conductor paste for defrosting but also, printed a receiving antenna of FM, AM, TV and etc., recently, the function trends toward a variation.
- Others(for tempered glass)
  In case of other automotive glass: automotive side glass, sun roof and etc., on high temperature, form a normal glass plate of 3.2㎜ ~ 5.0㎜ and quenched a cool air of 40 ~ 50℃ and then a glass made a compressive stress on the glass surface.

3.2.1 Black paste for front windshield(580 ~ 650℃) - Unleaded, Leaded (IR-type, UV-type)

- 4708S Lead bearing black paste for windshield
- 4701G Lead bearing black paste for windshield
- 24704-38 Lead free black paste for windshield

Paste No. Contents	Black Paste for front windshield			Remarks
	Leaded		Unleaded	
	4708-S	4701G	24704-38	
Coefficient of thermal Expansion(X 10-7/ °c)	86	89	79	Dilatometer
Transition Temp(°c)	420	440	465	Dilatometer
Softening Temp. of Dilatometer(°c)	480	500	520	Dilatometer
Drying temp(°c)	150	150	150	3min
Burn out of Vehicle(°c)	450	450	450	
Firing temp(°c)	550~600	590~640	560~640	
Average Particle Size(㎛)	3.1	3.2	3	CILAS 1064
Phase structure	No crystalline			
Usage	Laminated			

3.2.2 Black paste for rear window (640 ~ 720℃) - Unleaded (IR-type, UV-type)

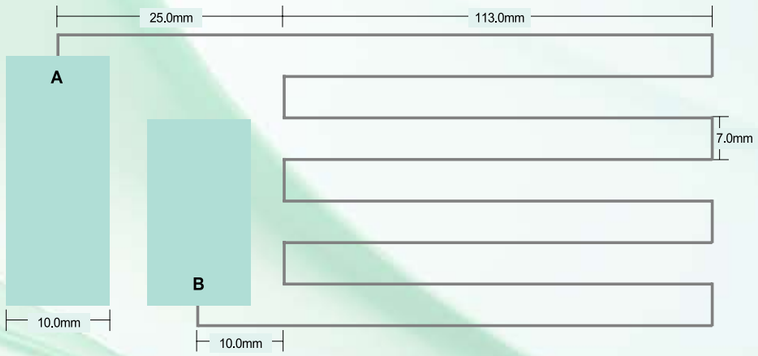
- 24707M Lead free black paste for rear window(Crystalline/Anti-stick)
- HD24709M-20S Lead free black paste for rear window(Crystalline/Anti-stick/Silver Hiding)
- HD24709M-2M Lead free black paste for rear window(Crystalline/Anti-stick/Silver Hiding)

Paste No. Contents	Black Paste for rear window			Remarks
	Unleaded			
	24707M	HD24709M-20S	HD24709M-2M	
Coefficient of thermal Expansion(X 10-7/ °c)	86	89	76	Dilatometer
Transition Temp(°c)	450	440	465	Dilatometer
Softening Temp. of Dilatometer(°c)	530	490	520	Dilatometer
Drying temp(°c)	150	150	150	3min
Burn out of Vehicle(°c)	450	450	450	
Firing temp(°c)	650~710	650~690	670~710	
Average Particle Size(㎛)	3.2	3.2	3.4	CILAS 1064
Phase structure	Crystalline(anti-stick)			
Usage	Normal	Silver Hiding	Silver Hiding	

3.3 Silver Conductor Paste - For defogging and defrosting, For Antenna

Paste No. Contents	050	073A	080
Silver	50%	73%	80%
Viscosity(22℃)	400±50		
Rion (VT-04) (ps)			

3.3.1 Resistance of Silver paste



※Printing : 200mesh
※Firing temperature
: 680℃ /165sec /shocking time
※Test area : A → B(1,000㎜)
※Line width : 1.0㎜
※Line thickness : 20.0㎛

Item(%)	050	073A	080
Ω/1,000㎜	17.5Ω	7.1Ω	4.3Ω

3.4 Product's Form

- Generally, we are supplying the paste mixed with black color powder and medium. The medium is divided and produced into two types. That's, IR type treated with the heating drying and UV ink type suitable to the curing process by UV-light.

3.5 Printing Room Conditions

- On a screen printing, it is very important that the printing environment must keep clean.
That's why the clean status guarantee a high quality. The temp. of the printing room is 25±2℃, the humidity is less than 50±10% and the control of a dust must be complete.

3.6 Viscosity Control

- The viscosity of black paste used on printing work must keep equal.
- The first viscosity of a manufactured black paste is 150 ~ 500ps(Rion(VT-04)/24℃). Before printing, according to a supplier's recommending, after adding the black paste to 1 ~ 3% medium, in case of machine printing, if the viscosity keeps 180ps±20ps(Rion(VT-04)/24℃), you can get a good printing effect.

3.7 Choice of Screen

The quality of the material : Nylon, Polyester, Stainless steel screen

- Mesh	IR type black paste	61 ~ 77T Threads/㎝
		155 ~ 195mesh/inch
	UV ink type black paste	90 ~ 100T Threads/㎝
		230 ~ 255mesh/inch
	Silver paste	77T Threads/㎝
		200mesh/inch

3.8 Drying Condition

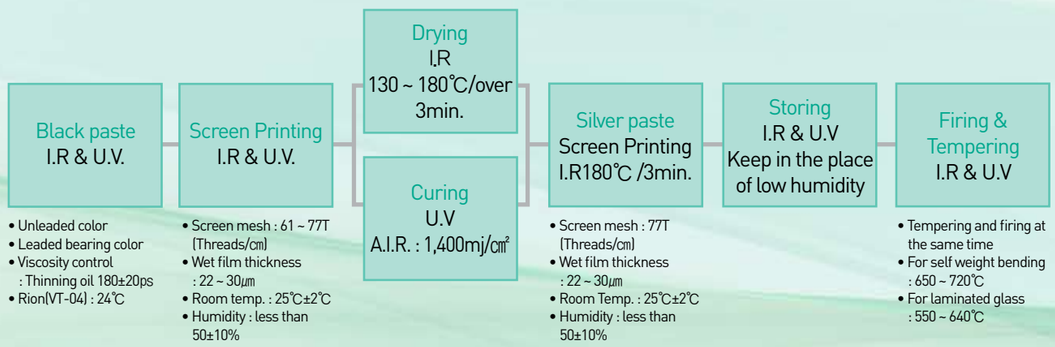
- IR type black paste : over 3minutes under 130 ~ 180℃
- UV type black paste : Accumulated Intensity of Radiation(A.I.R) 1,400mj/㎠

3.9 Printing thickness

- During a printing work, a worker must control the printing thickness at any time and keep the thickness 22 ~ 30㎛.

3.10 Firing Process

- This black color paste is tempered and fired on the glass at the same time.
Accordingly, tempering process is same as that of firing.
However, Black paste color of laminated glass is softened and cooled slowly during firing.



Inorganic Pigments

4.1 General property of Inorganic pigment

- Generally, the property of Inorganic pigment classify Body stain, Glaze stain, Underglaze stain, Inglaze stain and Onglaze stain etc., according to coloration method.

4.2 Application

- It is used as a colorant of Aluminum Enamel, Iron Enamel and Porcelain Tile etc.
  And, as mixed with a glaze, it can be applied to by Dipping, Powder coating, Spray.

4.3 Coloration Temperature

Kinds of coloring agent	Coloration temperature
Body stain	1,200~1,350℃
Glaze stain	1,000~1,100℃
Underglaze stain	1,200~1,250℃
Inglaze stain	1,200~1,250℃
Onglaze stain	780~850℃

4.4 Properties of Inorganic pigment

Color number	Composition	Specific Gravity	pH	Oil Absorption	Ave. particle size(㎛)	CI. name
P51 cobalt blue	Co,Zn,Al	4.27	7.28	53.3	3.07	pigment blue28
P58 cobalt blue	Co,Zn,Al	4.42	4.66	29.6	2.52	pigment blue28
P59 cobalt blue	Co,Zn,Si	3.59	9.06	43.7	3.04	pigment blue74
P53 cobalt blue	Co,Zn,Al	4.3	7.19	30.1	1.00	pigment blue28
P70 black	Cu,Cr	5.25	5.22	22.3	1.88	pigment black28
P70L-2 black	Cu,Cr,Mn,Al	5.25	6.2	22.3	3.27	pigment black28
P70M black	Cu,Cr,Mn	5.25	6.9	22.3	1.2	pigment black28
P755 black	Co,Cu,Cr	4.97	5.54	28	2.17	pigment black27
P433 green	Ni,Ti,Co,Zn	4.92	8.17	34.1	1.91	pigment green50
P830 gray	Sn	6.88	5.18	26.6	2.37	pigment black23

Glass Frits

Code	Coefficient of Thermal Expansion (×10^{-7}/℃)	Melting Temperature	Tg	Td	Remark
		unit : ℃			
26901	66.5	800	490	535	Unleaded
60100	80.0	750	460	535	
6955	67.4	750	480	535	
6029	79.8	730	460	525	
RC260	59.0	830	520	590	SiO_2,B_2O_3,ZnO,R_2O
40500	70.0	630	470	510	
40300	89.0	620	450	500	
50400	74.0	640	480	520	
90100	85.0	570	450	485	
F-69	66.5	620	470	510	Unleaded
F-4030	78.4	580	460	510	
50600	77.5	610	445	515	
45900	86.5	650	443	523	Bi_2O_3,$SiO_2B_2O_3R_2O$
Ag-frit	78.3	540	440	480	
50500BL	71.0	570	430	475	Unleaded, CoO
6000BL	66.0	750	460	500	
50600BL	67.0	560	425	470	Unleaded, Bi_2O_3,CoO
23901	50.0	800	475	535	Leaded PbO,SiO_2,B_2O_3,R_2O
3000-27	76.5	750	440	505	
3000	77.4	700	440	500	
3100	83.1	680	420	470	
3955	73.0	700	430	455	
FW-2002	58.0	650	475	525	
SW5000	87.0	580	430	480	
5000	86.4	580	420	470	
S-4000	75.8	620	440	500	Leaded(Li_2O Free)
B-4000	73.2	600	405	470	
550	89.1	580	410	460	
5030	78.5	600	450	495	PbO,SiO_2,B_2O_3,R_2O
V-560	67.0	570	440	480	
LE25	88.0	600	440	490	
LE45	57.0	610	455	500	
7000	78.0	580	420	460	Leaded PbO,SiO_2,B_2O_3,R_2O
SR7000	90.2	530	405	450	
8000	82.7	500	400	445	Leaded, PbO,SiO_2,B_2O_3
5030BL	77.0	590	440	495	Leaded PbO,SiO_2,B_2O_3,R_2O,CoO
3000BL	68.0	700	450	490	
7000BL	74.5	560	395	450	
8000BL	85.6	480	385	420	

Mediums

6.1 Mediums for Indirect printing

6.1.1 Decal medium and Decal coating medium

- Mediums are used mainly as a media of ceramic colors for decoration of porcelain, glass etc., and on screen printing, applied to the field of a decal transfer application.
- Generally, Onglaze colors can be mixed a decal medium (7-10 : gravimetric ratio) in a power form color (10) and Glass colors can be mixed a decal medium(5~9) in a glass color (10).
- According to the volatilization of a decal medium, if the drying time is fast, it takes 30~40 min. to be dried but if not, it takes 3hours to be dried. The temperature, the humidity and other circumstance conditions of a chamber dryer are key point.
- As a detergent of screen mesh, it can be used a hydrocarbon (ex. Xylene).

6.1.2 Component and Properties

Decal medium 3840		
Component	Acryl resin, Solvent, Additive	
Chemical property	Non volatile matter (ASTM D1644B)	Approx. 50%
	Viscosity (25℃)	1,200~1,500cps
	Maximum acid value (mgm KOH/g)	Approx. 1
	Specific gravity (20℃)	Approx. 0.89
Physical property	Liquid, immiscible in water boiling point	Approx. 160~172℃
	Flash point	Approx. 38℃

Decal film solution 3860		
Component	Acryl resin, Solvent, Additive	
Chemical property	Non volatile matter (ASTM D1644B)	Approx. 48.5%
	Viscosity (25℃)	2,100~3,000cps
	Maximum acid value (mgm KOH/g)	Approx. 1
	Specific gravity (20℃)	Approx. 0.95
Physical property	Liquid, immiscible in water boiling point	Approx. 152~168℃
	Flash point	Approx. 37℃

6.2 Mediums for direct printing

6.2.1 Thinning oil and Mediums

- The thinning oil or Medium to be used for thinning the pastes should be that specified by the paste manufacturer.
- The medium must burn away cleanly during firing, so as not to cause " Blistering ".
- Only use the minimum amount of thinning medium to adjust paste to screening viscosity.

6.2.2 Kinds and Properties of thinning oil

Item	Properties	Remark
6850	Thinning oil/oil based	Normal dry method/normal viscosity (900cps)
AM505	Thinning oil/oil based	Normal dry method/normal viscosity (190cps)
6500-3	Thinning oil/oil based	Normal dry method/normal viscosity (310cps)
MD603	Thinning oil/oil based	Normal dry method/normal viscosity (220cps)
6801P	Thinning oil/oil based	Normal dry method/normal viscosity (100cps)
6801PG	Thinning oil/oil based	Normal dry method/normal viscosity (90cps)
MC205	Thinning oil/oil based	Normal dry method/normal viscosity (230cps)
IR255	Thinning oil/oil based	Normal dry method/normal viscosity (220cps)
TH100N	Thinning oil/oil based	Usable to all mediums without AM505
TH 100	Thinning oil/oil based	Usable to all mediums without AM505
TH 500	Thinning oil/oil based	Only for AM505

6.2.3 UV Ink

- As an oil for direct printing, this is a medium cured by U.V. radiation against a medium for the I.R. drying by a heat
- General properties are the same to a medium for I.R. type but need U.V. lamp instead of a dry kiln.

Item	Property	Remark
UV ink	Thinning oil/oil based	Accumulated Intensity of Radiation (A.I.R.) 1,400mj/㎡

6.2.4 Wax : Thermoplastic resin

- The hot colors consisted of thermoplastic medium that is starting to melt at 60~80℃ and print it on cold substances. It is special notices that the melting temperature must be not over decompose temperature 100℃ that causes of unacceptable printing results in colors.
- Prepare liquid form of paste color after heated approx. 60~80℃ and start to print.
- The material of screens is recommended stainless steel and heat by D.C. electric currency.
- Thermoplastic form is, as its name, a form for hot-working by heating. And its heating temperature is 60~80℃. If its heating temperature is over 100℃, because the color components can adversely affect the decomposition, require attention.
- Heated form becomes a liquid. Put this color on the screen and perform the print job by heating at 60~80℃.
- The screen is heated by flowing the voltages and the electric currents. In this case the screen of stainless steel is best.

6.2.5 Water-soluble medium

Item	Properties	Remark
6804P	Screen printing	Normal dry method/normal viscosity (80cps)
W-Oil	/Water soluble	
TH100G	Thinning oil	thinner only for water-soluble medium

New Products

7.1 Silver Stain

Silver stain can be widely applied to hard and soft glass products of equipments such as medical, scientific, thermometer and mild container decoration, which develop dark brown, light yellow etc., by penetrating into the surface of the substrate.
(Example) No.0165 : Silver stain color

1. Silver stains are supplied in paste type and applied directly by screen printing method after controlling of the viscosity by adding optimum amount of the screen media squeegee oil.
2. The color tone depends on the type of the glass products, so required the optimum firing temperature / time for the specific glass products by laboratory testing before actual production.
3. After firing the printed glass, clean up the surface of the glass by brushing and washing. For mass-production, recommend to use an ultrasonic-water or an immersion in weak hydrochloric acid solution for the prompt removing the residues on the printed surface.
4. Mainly applied by screen printing, spraying and dipping method for the specific decoration.
   Recommendable dry powder type of the silver stain for the application of the ceramic transfers.

7.2 Reflective Ink

Used for reflection effect by coating it on the surface of the goods.
Generally, after processing a flat glass, printing it on the glass, and tempering it (680℃ ± 40℃).
It also can be applied to glass bottle, glass cup, tile and ceramic ware.
: Temperature range is between 500℃ and 800℃, The applied colors are Silver, Gold and Brown.

7.3 Ceramic ink for Pad printing

Curved wares had relied on transfer paper but, with the introduction of Pad printing method, can maximize operation efficiency. (Especially, glass plate, porcelain plate)

7.4 Etching ink

By coating this ink on the ware's surface, it can represent the chemical etching effects. Mainly, after processing a flat glass, it is printed on the glass surface, and tempered. For each color, there is unleaded and leaded.

7.5 Special ink for glass

- Transparent Ceramic Glass (C.T.E = 0)
  Even at high temperatures, it maintains the properties.
- Black Ceramic Glass (C.T.E = 0)
  Like a photograph, it is used for non-slip, it is difficult to apply it as the existing ink but, it can be applied easily to glass tempering process (approx. in 2min. 20sec.)
- Borosilicate Glass (C.T.E ≤ 50)
  Ceramic ink applicable to Low expansion glass.

7.6 Hybrid Ink

- Screen printing possible
  As nonflammable, echo-friendly materials, by coating it on the metal plate, it can soften the feel of the metal with the cold and the dull properties.
- Bending strength is excellent.
  After coating it on the metal plate, according to the property of a soft metal, it can keep a bending strength.
  → External appliances (refrigerators, air conditioners, ovens, cell phones)
- Echo-friendly ceramic ink
  It does not use any organic resin. It is used only ceramic binder (solid, liquid) and ceramic color.

Reference

8.1 Chemical resistance test for glass color

8.1.1 Acid resistance test (ASTM C753-93)

1. HCl solution (Vol.27% + 73%)
   After diluting 73% volume of a distilled water with 27% volume of a hydrochloric acid (HCl, sp, gr, 1.19), the temperature keeps on 25±5℃.
2. After putting a sample in a beaker, immerse the sample half in the above HCl solution (2.1.1) and then cover
3. After 20minutes, take the sample out of the HCl solution, wash it out and then dry it.
4. Record the temperature of the first and the last test time.
5. Make a grade according to the surface state.

8.1.2 Alkali resistance test (ASTM C675-91)

1. Alkali solution

NaOH wt%	9.10%
Na_3PO_4. $12H_2O$ wt%	0.90%
Distilled water wt%	90%

2. Fix the above alkali solution (2.2.1) on the temperature of 88±1℃, immerse half the sample
- every 2hours, take it out of the solution, wash it out with a warm water and then dry the surface of the sample with a dry rag, observe the surface state. Every 2hours, with repeating the test, record the repeated times by the fired surface is removed approaching to 90%.

8.1.3 Acid resistance test (ASTM C753-93)

※ Reagent

ⓐ Sodium sulfide($Na_2S.9H_2O$), reagent grade
ⓑ acetic acid(CH_3COOH.min99.8%), reagent grade

- Mix 4㎖ of an acetic acid with 96㎖ of a distilled water, make 4% of an acetic acid solution.
- Dissolve an excess amount of sodium sulfide in warm(35 to 40℃) distilled water. Make sure there is undissolved sodium sulfide left over. Cool to room temperature.
- Stir into each100㎖ of the 4% acetic acid solution 1㎖ of saturated, clear, sodium solution for 2 or 3min.
  A milk of sulfur will be precipitated.

[Test method]

① Place the test specimens and the reference standard of known resistance into the test solution prepared according to the above(2.3.3) at room temperature so that only half of the decoration is immersed. Stir and cover.
② Remove specimens from solution after 15min. And allow to air dry.
③ Note the degree of attack after 15min by visual observation and grade.

8.1.4 Thioacetamide(CH_3CSNH_2) TEST

1. Mix 35% HCl(28.56g) with Distilled water(171.44g)
2. Put 20g Thioacetamide into the above solution and stir it well approx. for 10min.
3. Put the well-stirred solution in glass container, and, after installing separator, place the experimental sample on the separator and then close the lid.
4. At this time, keep the inner temperature of Hood and the temperature of the laboratory equally (27 ± 3℃)
5. Take out the experiment, one sample every 7days and observe the surface, and then grade on it.

Interpretation of Results

WS	: Very very slight
S	: Slight
SM	: Slight to Moderate
M	: Moderate
H	: Heavy

8.1.5 Calgonite Solution Test

1. Make a solution of 0.5% Na_2CO_3
   Water(distilled water) 0.5gNa_2CO_3
2. Fix the above solution at 77 ±1℃ and immerse the experimental sample half in the solution, and then keep it for 16hours.
3. After 16hours, take it out of the solution and wash it by water, and then, observe the surface.

8.2 Products Form

8.2.1 Powder form color

- As a hygroscopicity of Powder form color, before using it, you had better using it after drying it about 130℃,
  As absorbed a humidity, if it does not mix a medium for printing with a powder evenly, the fluidity of paste conditions goes bad and it can make a problem on the printing conditions.

8.2.2 Paste form color

- Paste form color is the color that mix a medium of oil suitable for the usage in Powder form color and then make dispersed it. The mixing ratio of the medium can be different according to the printing work.
  That's, according to the technique of Decal transfer, Direct printing, Dipping, Spraying, Hand painting, you must use a medium of oil differently and control the viscosity differently because the mixing ratio also is different.
  On the firing course, this medium of oil must be volatilized or burnt to nothing completely and does not occur the bubble state. Therefore, before using it, a user makes a prior consultation fully with a supplier.

8.2.3 Thermoplastic form color

- Thermoplastic form color is a color that mix a powder form color with a wax for thermoplastic form.
  Though it is a solid type on the normal temperature but on 60 ~ 80℃, it is changed to a paste color suitable for printing.
  At this time, the temperature suitable for printing keep be controlled by stainless steel screen charged with electricity or equipping a heater with a top part of a screen.
  Generally, we recommend to use a paste form color on the curved surface glass printed only the first printing.
  And in case of over the second printing, the printing on the curved surface glass can save the trouble of drying and clear up the difficult of taking the right track of by using thermoplastic form color.

※ Thermoplastic color using method

- Screen frame is made of mainly an aluminum, an alloy or a wood. In case of using a wood, the touched part with screen is treated with a conductor tape for charging with electricity.
- Screen is chose by the quality of stainless steel material, used 180 ~ 305mesh/inch.
- Before printing, you melt thermoplastic form color in advance on 70 ~ 80℃.
- On the prepared screen frame, you charge with electricity.
  Voltage : In case that screen size is within 10X20㎠, you charge with12volt. On over the size, you charge with 20volt.
  Electric current : keep 10 ~ 13A but the temperature of the screen must be controlled differently according to the times of printing.
  By the resistance of the quality of the screen material, the temperature of the screen become 70 ~ 80℃.
  At this time, the using squeegee rubber is a soft type.